DEPARTMENT OF AGRICULTURE

JOURNAL

VOLUME XXXVII.

INDEX

DUBLIN:
PRINTED FOR THE STATIONERY OFFICE,
BY HELY'S LTD., DUBLIN.

CONTENTS

AN APPEAL FOR INCREASED AGRICULTURAL PRODUCTION

Broadcast from Radio Éireann on Tuesday, 10th October, 1939,

BY

THE MINISTER FOR AGRICULTURE.

I have no doubt that many listeners, particularly amongst urban populations, will decide that a talk by the Minister for Agriculture has no interest for them. Yet an increase in agricultural production in this time of world crisis is of more intimate concern to the residents of towns and cities than to the men and women of the countryside. The loaf and butter of the working-class breakfast table, the toast and poached egg or the bacon and sausage of the better-off classes were yesterday's raw materials from the farm. What appalling disappointment and dissatisfaction would result if those necessary foods were not forthcoming in sufficient quantity. No owner of land need go hungry. It is not so with townspeople. When, therefore, I talk to farmers and ask them to increase agricultural production it is partly for the sake of town dwellers and other non-agriculturists that I make the appeal.

In spite of our efforts during the last seven years to increase home production, particularly of cereals, we are still greatly dependent on imports and one week of the war was sufficient to show our vulnerability in this direction. Taking the two most important items, we imported in 1938, 370,000 tons of wheat and 350,000 tons of maize. In addition, we imported 60,000 to 80,000 tons of other feeding stuffs for animals.

It is said that wars usually take place after harvest time when national food lockers are full. Although we are not belligerents it was fortunate for us that the outbreak of the war occurred after a bountiful harvest and after our farmers had provided the nation with a supply of wheat almost equivalent to four months' bread supply. I may say in passing that while our daily bread and our household flour are at present being made chiefly from home-grown wheat, our own wheat has to be augmented by imported wheat of which a certain reserve was in stock, and no one can definitely say how long it will be possible to provide our people with a loaf of the present standard or even to provide in sufficient quantity a greatly inferior loaf.

The more our tillage declined during the last seventy or eighty years

the more dependent we became on maize imports. The outbreak of war found the country short of maize. Frantic appeals were made by pig and poultry feeders and, as farmers already know, the position was met by making available for animal feeding certain supplies of wheat in a flaked form. There is reason to hope that supplies of maize will be again available after some time, but in what quantity it is impossible to say.

A shortage of wheat and a corresponding shortage in the bread supply of the people would obviously be a very serious matter. A reduction in our imports of animal feeding stuffs would also have grave consequences. These imported foods, plus the 110,000 tons of wheat offals derived from imported wheat, making a total of 500,000 tons of concentrates, are the equivalents of 2,000,000 cwts. of bacon, or of 900,000 cwts. of beef, or of 1,250,000 cwts. of butter. These quantities represent such a considerable proportion of our output of finished products that a corresponding drop in production would at some stage mean an alarming reduction in our flocks and herds, and would, in fact, entirely dislocate the national economy. I hesitate to strike an alarming note in regard to our supply of foodstuffs for man and beast. It may be that as transport difficulties are overcome the position may improve and that supplies may reach us in reasonable quantities. On the other hand, we are far from sources of supply and our needs will inevitably have to give way to merchandise which carrying companies will regard as of greater importance. We cannot possibly afford to take a risk and in these circumstances the Government has during the past few weeks given careful consideration to measures designed to meet the situation.

There is now no doubt of our capacity to produce excellent wheat or to grow sufficient sugar beet to provide our full requirements of sugar. Maize can be replaced by other cereals, such as oats and barley, or partly by potatoes and root crops. The real problem, therefore, was to devise means to increase the area under these crops. We were faced with two alternatives. The first was to secure an increase in production by so-called compulsory methods. The other was to place the facts of the situation before the farmer, offer him certain inducements and appeal to him to do his utmost in this grave emergency to provide a sufficiency of food for the nation.

We finally decided on what may be regarded as a combination of these alternatives. The Compulsory Tillage Order to be made under the Emergency Powers Act will require a minimum of 12½ per cent. of the arable land in every holding comprising ten or more statute acres of arable land to be under tillage crops excluding first year's hay. I realise that except in perhaps six or eight counties and on a limited number of farms in other counties this Order will not involve any real compulsion, for the simple reason that elsewhere a much greater area than the minimum required by the Order is already being cultivated. I feel confident, however, that the

farmers in the tillage counties and the tillage farmers in the grazing counties who have all the necessary farm equipment will in their own and the country's interest do their utmost to increase their tillage next season. This is why I say that the Scheme is a combination of compulsion and appeal. I have previously said that I do not like the idea of compulsion and I am not without hope that in practice compulsion will rarely need to be applied even in the grazing counties. We have had abundant evidence of the good-will and co-operation of farmers and I believe that the legal obligation to till the requisite area and possibly a greater area will be cheerfully accepted. If compulsion is taken in this spirit, as indeed it ought to be in present circumstances, the country's food supply will not be in jeopardy next season. It would, of course, be too much to hope that all landholders will realise their duty to the country at this time. While the Order will be administered sympathetically and considerately, it may unfortunately become necessary in some cases to adopt drastic measures if and when any occupier of land makes no reasonable effort to comply with the Order.

Both in the case of the farmer who is compelled to till more land and the farmer who responds to an appeal to increase his tillage voluntarily, it is only equitable to offer a remunerative return. In considering this aspect of the matter the Government had to bear in mind that the great bulk of the farmer's produce is grown for use on the farm itself and that, strictly speaking, there is no cash market for most of the raw products in themselves. This applies particularly to potatoes, roots and oats, to much of the barley crop and, of course, to hay and straw. Moreover, the sale of these crops through the medium of animals and animal products is the best and most economical method of disposing of them. One such finished product, namely butter, is already highly subsidised and attractive prices are obtainable for others and are likely to become still more attractive in the future. There are, however, two crops which can be grown widely throughout the country and for which there is an almost unlimited market, namely, wheat and sugar beet, and for each of those it is proposed to guarantee the growers a definite price. I have already stressed the importance of the wheat crop and so desirous is the Government of increasing the wheat acreage and of safeguarding the bread supply that a top price of 35s. per barrel will be guaranteed for next season's crop. I hope that this attractive price will result in the cultivation of at least 350,000 acres, sufficient to provide half our requirements of wheat next season. The wheat-growing season is now at hand and I earnestly request all growers, old and new, to get going at once. Growers who may wish to procure imported seed have already been advised to hold sufficient of their own wheat until imported seed is available and new growers have also been advised to look for supplies to their neighbours. Supplies of imported seed are now arriving, but, owing to transport difficulties, somewhat more slowly than usual. It is, however, confidently expected that during the next couple of weeks much

larger quantities will arrive. In the meantime there is no cause whatever for panic if a merchant fails to supply imported wheat immediately it is ordered. Spring wheat seed will, however, be scarce and also dear and if for no other reason than this, growers should do everything possible to sow Winter wheat. I am equally concerned about our sugar supplies but there should be no difficulty in getting 60,000 acres of sugar beet, which will leave us independent.

I realise that there are districts where sugar beet growing is not practised and where wheat is not grown for sale, and that the guaranteed prices for these crops will not help farmers in such areas. While a certain amount of tillage is done in these districts the main industry is the raising of store cattle and sheep and, to a lesser extent, the production of milk. Increased production of these commodities is closely connected with the increased use of artificial manures and, chiefly in order to meet the special conditions in such areas, it is intended to re-introduce, with some modifications, the Fertilizer Scheme which proved so popular last season. It is also intended to increase considerably the funds already made available for the production of cheap lime. These schemes will, of course, apply to the country as a whole, but they will specially benefit the districts in question.

It must not be inferred, that I anticipate an increased wheat acreage only on the holdings on which the crop is grown for sale. Wheat demonstration plots throughout the Congested Districts have shown year after year that, with proper manuring, even on the poor land common in those areas, remarkably good crops can be obtained. Half a statute acre of wheat will produce 60 to 100 stones of whole meal flour, and what a standby this would be for a small farmer and his family !

In order to assist farmers who may require to purchase farm implements it is proposed to extend the existing loan scheme administered by the Department to implements costing up to £100 and to make loans available at a rate of 5 per cent. per annum.

It might be assumed, from what I have said up to the present, that I hope for an increase in tillage merely sufficient to replace such imported foodstuffs as will not be available. I expect much more than this, not only in tillage crops but in all agricultural products. Producers have now an opportunity of disposing at attractive prices of more beef, more bacon, more butter, and more eggs and poultry. The extra production of these commodities will only be possible if we produce more oats, barley, potatoes and roots to replace imported maize, wheat offals and oil cakes ; in other words, if we have increased tillage.

Let me therefore appeal, firstly, to the farmers in the grazing districts who will primarily be affected by the Compulsory Order. You may be

justly proud of your splendid grazing land and of the beautiful cattle it produces, and you are doubtless unwilling to break up any portion of it. Remember, however, you owe a duty to the community which, in these times, you must not forget, the duty to supply your fellow-men with bread stuffs. You can do this and still produce cattle on the bulk of your land. The nation is not making an unreasonable demand upon you. You know the extent of your legal obligations under the Compulsory Tillage Order. Do not wait until the Tillage Inspector arrives to point out your default. Remember that he gives twice who gives with a good will.

Let me appeal, secondly, to the men whom the Compulsory Tillage Order will not affect, the farmers throughout the country who have already much more than the minimum 12½ per cent. under cultivation, the men who have truly been described as the backbone of the country. You, better than anybody, realise the difficulties—due to weather and other causes—of the tillage farmer. On the other hand, you have never lost the art of tillage, you have got all the necessary tillage equipment, and most of you can increase your already extensive tillage area with some effort. An extra ten per cent. on your farms, or even five per cent.. plus the increase in the grazing districts, will go far to procure that half million acres of extra tillage which I expect next season. I make this appeal to you in your own interest, having regard to the remunerative prices you will be guaranteed for two basic crops and in view of the attractive prices almost certain to obtain for your finished products for a considerable time to come. I appeal to you also in the interests of our people who would suffer great privations from a shortage in food supplies.

And now a word to another section of the agricultural community, viz., the agricultural labourer. The Labourers' Housing Acts have been responsible for the disappearance of the hovels which once disgraced the countryside and for the substitution of hygienic cottages with an attached plot of land—a statute acre in most cases. It is saddening, however, to see—up and down the country—those acre plots unused or badly used. Devoted in the main to poor pasture on which run perhaps a few poor fowl, those plots could be made to yield valuable sustenance for the labourer and his family. I have already mentioned that half an acre will produce 60 to 100 stones of whole meal flour. The remaining half will produce 4 to 5 tons of potatoes. Again, what a standby for the labourer and his growing family, who now await the coming of the baker's van. Is it too much to ask labourers to make better use of those plots, not only in present circumstances, but for the future ? Is it too much to ask their employers to facilitate them by lending horses and implements, and by providing farmyard manure or seed potatoes, seed oats or seed wheat, as the case may be, at reasonable prices ?

There is still another section to whom I wish to appeal, namely, the great

number of people who own vegetable gardens or who can procure an allotment. Already some 5,500 persons—many of them unemployed persons who are provided with plots at merely nominal rents and with free seeds and manures—hold allotments at various urban centres throughout the country, and considerable quantities of valuable food have been produced on those plots since the allotments scheme was established. It is intended to extend this Scheme, not only for unemployed persons, but also for persons who can afford to pay an economic rent for their plots. I trust that the many Local Authorities who have not so far fully availed themselves of their powers of providing allotments will do so at an early date.

And now a final word to all who can produce more food, farmers, agricultural labourers, the owners of vegetable gardens, or allotment holders :—

We have no army in the fighting lines to feed but we have the non-combatants, the poor and destitute, the old and infirm, the children, the masses who, in the best of times, find it hard to provide adequate sustenance for themselves. They all look to you to produce that food to enable them to withstand the repercussions resulting from a great clash of arms in other lands. We can come successfully out of this emergency if we all pull our weight. It must be a strong pull and a long pull but above all let us pull together. If we do the victory will be ours.

NOTES ON THE EMERGENCY POWERS (No. 12) ORDER, 1939, RELATIVE TO CULTIVATION OF LAND IN 1940.

1. The Emergency Powers (No. 12) Order, 1939, provides, subject to certain exceptions which are mentioned in paragraphs 10 and 11 of these Notes, that every occupier of ten or more statute acres of arable land shall in 1940 cultivate and maintain in cultivation an area equivalent to at least one-eighth of such land.

2. The Order takes effect notwithstanding any covenant, agreement, condition or provision as to the user of the "holding" and no such covenant, etc., shall operate so as to penalise, impede or interfere with the cultivation required by the Order. Land let on the eleven months' system comes under the Order and the obligation to cultivate the requisite area in respect of such land lies on the person rated or liable to be rated for it.

3. *Definition of Occupier.* An occupier is defined as the person who is rated or liable to be rated in respect of the land.

4. *Definition of Holding.* For the purposes of the Order an occupier's "holding" means all arable land in his occupation in the State. If he has two or more farms he must cultivate at least one-eighth of the total area of arable land comprised in all the farms but the selection of the farm or farms on which the requisite cultivation will be carried out is left to his discretion.

5. *Arable Land.*—"Arable" means capable of being tilled. Building lands, if arable, come therefore within the provisions of the Order as do also demesnes, save parts thereof on which timber would interfere with the cultivation or harvesting of crops.

6. *Non-Arable Land.*—The following are examples of land, which will be regarded as non-arable and, therefore not within the scope of the Order——rough mountain grazing, unreclaimed bog, sand dunes, land regularly subject to flooding, land under timber, land recently planted for forestry purposes and land on which the cultivation and harvesting of crops would be interfered with by timber.

7. *Meaning of "Cultivation" or "Tillage."*—Cultivation or tillage comprises ploughing together with the subsequent operations necessary for the production of a crop. For the purposes of the Order the production of the ordinary farm and garden tillage crops such as cereals, potatoes, roots and

other green crops, flax, fruit and vegetables will rank as cultivation, but first or second year's rotational grass, whether mown or grazed will not so rank. Land sown during the winter 1939–40 with a winter cereal for harvest in 1940 will be regarded as cultivated in 1940 even though the crop was sown prior to 1st January, 1940. The choice of crop to be grown on land cultivated in compliance with the requirement of the Order is left to the discretion of the occupier. It should, however, be observed that the Order expressly provides that the sowing of grass seed or grass seed and clover seed without a " nurse " crop will not be held to be cultivation.

8. *Nurseries and Orchards.*—Land used as nurseries for the propagation of fruit or forest trees or ornamental shrubs and bushes will be regarded as cultivated. Orchards, if properly planted and managed, will also be regarded as cultivated but lands which are in grass and on which the fruit trees are unreasonably wide apart or on which the fruit trees have not received attention as regards spraying, etc., will not be regarded as cultivated.

9. *Conacre tillage and allotments.*—If an occupier arranges for the cultivation of his holding in 1940 either in conacre or by allotment holders such cultivation will, for the purposes of the Order, be regarded as cultivation by the occupier.

10. *Exceptions or exemptions.*—As indicated in paragraph 1 of these Notes the Order does not apply to a " holding " comprising less than ten statute acres of arable land (see also paragraph 4 of these Notes). Neither does it apply to a " holding " which is or forms part of a public park, public recreation ground or an aerodrome. Occupiers of such lands are, therefore, under no legal obligation to cultivate any part thereof, and it is not necessary for them to make application for exception.

11. *Permissive exceptions or exemptions.*—The Minister for Agriculture may, on the application of the occupier, declare a " holding " or a part thereof to be excepted from the provisions of the Order if he is satisfied that the entire " holding " or a part thereof—

(*a*) is required in the year 1940 for the purpose of carrying on of an industry other than agriculture, and that its use for such purpose would be of greater service in national interests than its cultivation, or

(*b*) has been required and regularly used in the year 1939, and is required in the year 1940 for the accommodation, for periods not exceeding ten days at a time, of stock intended for disposal at auctions, fairs or markets, or for shipment or for the accommodation, as aforesaid, of stock held over from auctions, fairs or markets, or

(*c*) has been required and regularly used in the year 1939, and is required in the year 1940 for the accommodation of cattle or sheep intended for slaughter within fifteen days of their being accommodated on such holding, or

(*d*) has been required and regularly used in the year 1939, and is required in the year 1940 for the maintenance of a stud of high-class thorough-bred horses, or

(*e*) has been regularly used in the year 1939 as the track of a racecourse or as a paddock, ring or other enclosure, adjacent to the stand or stands of a racecourse, and is required for that purpose in the year 1940, or

(*f*) has been regularly used by an agricultural or industrial Society as their Show grounds and is required for that purpose in the year 1940, or

(*g*) is let for the year 1940 to, or is owned by, a club, the main object of which is the promotion amongst its members of any outdoor game played between two or more persons, which is affiliated to or recognised by the governing body of that game in Ireland, and has been regularly used by such club for the playing of such game in the year 1939, and is required by such club for that purpose in the year 1940, or

(*h*) has been used by any college or school in the year 1939 as a playing field, and is required for that purpose in the year 1940.

12. *Application for declaration of exception.*—Applications for declaration of exception must be made not later than 1st December, 1939, on a form which may be obtained from the Department. Where an applicant is a company, club or other association the application may be made by the Chairman, Secretary, or duly authorised agent. In many cases, lands used for industrial purposes or as an accommodation or butcher's paddock, a sports ground, playing field or show ground constitute the entire "holding" and comprise less than ten statute acres of arable land. In such a case the lands do not come within the scope of the Order and no application for their exemption is required. If, however, lands so used form only part of the "holding" or include ten statute acres or more of arable land, a declaration of exception must be sought by the occupier if he desires relief from his obligation under the Order to till at least one-eighth of all the arable land in his occupation. The onus of proof that land should be excepted from the provisions of the Order lies on the occupier and he will not be relieved of his obligation to cultivate simply by the fact that he has made an application for exception.

13. *Lands not used for the purpose for which they were excepted.*— A declaration of exception is, of course, only valid in case the lands are used in 1940 for the purpose for which the declaration is granted. An occupier who obtains a declaration of exception in respect of all or a portion of his lands but who does not use them in 1940 for the purpose for which they were excepted must therefore till them, or till in respect of them, to the extent prescribed by the Order.

14. *Requirement of the Order in case part of a " holding " is excepted.* If the Minister has declared that a portion of a " holding " comes within one or more of the exceptions set out in paragraph 11 of these Notes, the acreage to which the Order applies is the arable land comprised in the residue of th " holding." Thus, for example, a person occupying one hundred acres of arable land, of which thirty acres are excepted, would, for the purposes of the Order be regarded as occupying not more than seventy acres of arable land. If, after allowing for the excepted portion, the residue of arable land in the " holding " does not amount to at least ten statute acres no part of the " holding " need be cultivated in order to comply with the requirements of the Order.

15. *Inspection of Lands.*—Any person duly authorised by the Minister for Agriculture may, for the purposes of the Order, enter on and inspect any land and no one may lawfully obstruct or interfere with any person so authorised when he enters on or is inspecting the land.

16. *Penalties for non-compliance with the provisions of the Order.*—Failure on the part of an occupier to comply with the provisions of the Order constitutes an offence under the Emergency Powers Act, 1939 (No. 28 of 1939) and renders him liable to a fine of up to £100 or, at the discretion of the Court, to imprisonment for a term of up to six months or to both such fine and such imprisonment.

Moreover, if an occupier fails or does not take reasonable steps to comply with the requirement of the Order in regard to the cultivation of his land the Minister may enter on the land and cultivate it or any part thereof or arrange for any person to do so on such conditions as the Minister may direct.

GROWING WHEAT ON LEA OR "BAWN."

Although over one-third of the oat crop produced in this country is grown on lea land and frequently on old lea, a similar practice does not exist to any appreciable extent in regard to wheat, and many farmers are in fact under the impression that wheat cannot be grown successfully on land which has been in grass for a number of years. This belief is quite erroneous and particularly in respect of lea land in the tillage districts which in ordinary circumstances is broken up after being four or five years in grass. Such land can be reduced to a proper seed bed almost as readily as ground after a corn or a root crop and may indeed be prepared for sowing in more unfavourable weather. The prejudice against growing wheat on lea applies perhaps chiefly to the type of land common in the grazing districts, in other words, to land which has been in grass for many years—in fact in some cases for generations. If, however, the necessary extension in the wheat area is to be secured in the coming season—and this in present circumstances is imperative—a considerable area of old grass land of the type referred to must be placed under wheat.

A firm seed bed is of the utmost importance in successful wheat growing and in order to secure this on old lea, the ground should be ploughed as soon as possible. At present such land is in many cases bearing a heavy sward of grass which may be difficult to plough down and which may have to be mown previously. The best results will be achieved if a tractor plough is used, but whether tractor plough or horse plough is to be used, a wide share should be fitted and the sod turned almost completely over rather than "ribbed" in the usual manner. This procedure buries the grass effectively, leaves the ploughed ground comparatively firm and provides a surface which can be reduced to a sufficiently good seed bed without risk of tearing the sod or of again bringing the grass to the surface. The depth of ploughing may vary from six to eight inches according to local conditions but should be sufficiently deep to get well under the mat of roots which usually extends for some inches below the surface on this type of land. After ploughing, the ground should be thoroughly harrowed—preferably disc harrowed—until sufficient tilth is secured for the use of a corn drill. The ordinary farm roller has little effect on old lea of this type but, if a heavy roller is available it should follow the corn drill and be followed in turn by a light harrow.

As already mentioned, the growing of wheat on short or "young" lea presents little difficulty. It is, however, desirable to apply, particularly on light land, a dressing of artificial manure—say, up to four cwts. of potassic

superphosphate at time of sowing. Old fertile leas in the grazing districts may be expected to produce a satisfactory crop without the aid of artificials, but even on such leas two cwts. of potassic superphosphate would be beneficial, particularly in giving the crop a good start.

Detailed information on the growing of wheat is contained in the Department's leaflet No. 61, which may be obtained free of charge. Intending growers are also advised to consult the County Agricultural Instructors.

THIRTY YEARS OF SEED CONTROL IN IRELAND.

BY

H. A. LAFFERTY, D.Sc., F.R.C.Sc.I.

In 1869 the botanist Nobbe established in Saxony the first station for testing agricultural seeds where, with very little in the way of laboratory equipment, he showed that valuable information could be gathered about the quality of seeds before they were sown; but as has been the case with many other pioneers in the development of a scientific approach to agricultural problems the significance of his work was not fully appreciated at the time and he failed to elicit government support.

Two years later Holst, a Danish agricultural expert, opened a private Seed Testing Station in Copenhagen, but in this venture he was not more fortunate than Nobbe. During his lifetime he was denied government recognition and it was not until after his death in 1887 that the station was officially taken over and placed under the control of the Danish Ministry of Agriculture.

Fortunately the science of Seed Testing was viewed in a more favourable light in neighbouring countries with the result that Seed Control Stations were established under Government auspices in Hungary (1871), Switzerland (1875), Austria (1881), Germany (1891), and Holland (1894); but even as late as 1900 its value as an aid to good farming had not been recognised in official circles in the British Isles. It is interesting to record, however, that entries made in 1870 in the ledger of a Dublin Seedhouse indicate that it was a common practice for the head of the firm at that time to carry out "growth tests" of his stocks of agricultural seeds before offering them for sale.

However the question of Seed Control could not be long delayed and in May, 1900, the English Board of Agriculture, as it was then called, appointed a Departmental Committee, on which Ireland was represented, "to enquire into the conditions under which agricultural seeds are at present sold, and to report whether any further measures can with advantage be taken to secure the maintenance of adequate standards of germination and purity." This Committee held several meetings during June and July of that year and examined a considerable number of important witnesses including Government officials, scientists, seed merchants and farmers. The Report of this Committee and the Minutes of Evidence taken were published in

1901 and the latter contain a large amount of very valuable information concerning the quality of the agricultural seeds that were sold in this country. While it is not intended here to enter into a detailed examination of the evidence submitted, the general position at that time becomes reasonably clear when we read of witnesses freely admitting that the majority of farmers in Ireland knew nothing whatever about the quality of the seeds they purchased. Such rubbish as the screenings from clover seeds were imported in large quantities and this, together with the cleanings from ryegrass seeds, had a ready sale and was extensively used by small farmers in the counties bordering the western seaboard.

The ryegrass cleanings were distributed principally from Belfast and were known as "White Hayseed," owing to the enormous quantities of light-coloured seeds of Yorkshire Fog which they contained. This material which had bushel weights varying from 10 to 14 lbs. was usually sold whole-sale at from three to four shillings per quarter of eight bushels, and was retailed by small shopkeepers in the poorer parts of the country at prices ranging from one shilling to two shillings per bushel. One witness giving evidence at the enquiry volunteered the information that he supplied rye-grass seeds of 10 lbs. and 12 lbs. per bushel to retailers in County Kerry "who knew no more about the seed they handled than they did about the moon." The best case that could be made for the sowing of "White Hayseed" and similar material was that it appeared to be cheap, a belief that will be effectively refuted in a later part of this article; secondly it was held, and probably correctly so, that when this material was sown it produced a better herbage than would have developed if the land was left to "seed" itself—a rather common practice at that time.

With regard to the findings of the Committee of Enquiry the most important recommendation it made was that a central Seed Testing Station for the United Kingdom should be established under Government auspices, but for some reason or other this recommendation was not acted on. It was felt, however, that the deplorable state of affairs that existed in certain parts of this country, as revealed by the enquiry, could not be allowed to continue, and to deal with this matter the Department of Agriculture and Technical Instruction for Ireland, which began its career in 1900, established a Seed Testing Station in Dublin in December of that year. Fourteen years later an official station was opened in Edinburgh by the Scottish Board of Agriculture. In 1917 the English Board of Agriculture created an official station for England and Wales, and since then an official station has been established in Belfast under the control of the Government of Northern Ireland.

The Dublin Station started work under the part-time directorship of Professor T. Johnson in a portion of the Botanical Laboratory in the Royal College of Science which was then housed in St. Stephen's Green, and there,

Professor Johnson and one assistant tested for purity and germination in the first year between one hundred and two hundred samples of seeds. As time went on the number of samples sent voluntarily for test by merchants and farmers continued to increase slowly, and, in addition to these, several hundred samples of agricultural seeds were submitted annually by Agricultural Instructors between the years 1903 and 1908, as being representative of the quality of seeds used throughout the country. From the results of tests made on these samples the position was found to be so very serious that a whole-time Director of the Station, Dr. G. H. Pethybridge, was appointed. Dr. Pethybridge held this position until his retirement in 1923.

During the early years of the Station's activities the best that could be done was to make germination and purity tests of the samples of seeds that were sent voluntarily by farmers and merchants and to issue reports, but, since the Department of Agriculture and Technical Instruction had no powers under which it could exercise effective control over the sale of agricultural seeds, any improvement that might be brought about along these lines would of necessity be slow, and must depend entirely on the good-will and co-operation of the members of the Irish seed trade. It is true that the Adulteration of Seeds Act. 1869, was in force at that time, but, beyond making it a criminal offence to " kill " or " dye " seeds, this enactment did not prevent a merchant from selling any rubbish under the name of seeds.

In 1909 the Weeds and Agricultural Seeds (Ireland) Act became law and the second part of this Act, which dealt with the sale of seeds, marked the beginning of the end of the inferior seed trade in this country. Practically every country in the world has legislation of some kind or other dealing with the control of seeds ; but it is questionable if any country can show such a complete revolution in the quality of its agricultural seed as took place here following the enaction of this simple piece of legislation. This Act has since been repealed, but its terms have been re-enacted with minor alterations in the Agricultural Seeds Act, 1936, and though its three original Sections are known for the past thirty years to every seed merchant who does business in Ireland and to those who export seeds to this country, they are worthy of being reprinted here as a classic example of simple and effective legislation :

"Weeds and Agricultural Seeds (Ireland) Act, 1909."

Part II.—Agricultural Seeds.

5. (1) " Any Officer of the Department shall have power at all reasonable hours to enter the shop, store, or other premises of any person who sells or exposes or keeps for sale agricultural seeds for sowing, and to examine and take samples of any agricultural seeds that are upon the premises."

(2) "The person on whose premises a sample of agricultural seeds is taken under this Section shall, if the Officer requires, give the name and address of the person from whom he procured the seeds: and if he refuses to give such name and address or wilfully gives a false name or address he shall be guilty of an offence under the Act and shall be liable on summary conviction to a penalty not exceeding ten pounds."

6. "The Department may cause any sample of agricultural seeds taken under this Act to be tested for purity and germination and may publish in such manner as they think fit the results of the test and the names and addresses of the persons upon whose premises the samples were taken and of the persons from whom the seeds were stated to have been procured."

Though the activities of the Station, prior to the year 1909, may be occasionally referred to in passing, the main object of this article is to deal with the period of seed control between the years 1909 and 1939 and to show in a general way the results that have been achieved in that time.

Scope of the Work.

Fortunately the annual records of the work carried out at the Station are for the greater part still available and from these it has been computed that the total number of samples tested since 1900 was 165,366. This may not appear to be a very formidable record for almost forty years' work; but it should be borne in mind that almost every sample of seed included in this total was tested for both germination and purity. Many Continental Stations, which are frequently called on to make purity tests only, may show what appears to be a greater output of work, but when examining such records it should be remembered that a simple purity test may be carried out in a few minutes while the simplest germination test requires a minimum of ten days for completion, and in the case of certain grass seeds this period may even extend to twenty-eight days.

In a country like this where mixed farming is common, one would expect to find cereals and root seeds occupying the most prominent positions in the make-up of the grand total but, as may be seen from Table 1, about 80 per cent. of the seeds tested have been those of the grasses, and almost 70 per cent. of these have been seeds of Perennial and Italian ryegrasses. This is mainly due to the fact that Ireland, and particularly Northern Ireland, has been the world's greatest producer of seeds of these two grasses and an export trade has been built up amounting to some 80,000 tons of ryegrass seeds annually.

TABLE I.

Showing the Number of Samples of the various kinds of Seed tested since 1900.

Kind of Seed	Number of Samples
Grasses	50,814
Cereals	37,596
Clovers	27,129
Roots	18,225
Flax	16,954
Vegetables	3,416
Miscellaneous ..	11,232
Total ..	165,366

The original policy of the Department of Agriculture and Technical Instruction, when establishing the Irish Station, was that it should be primarily a farmers' station, and by way of encouragement a nominal fee of threepence per sample was fixed for a germination and purity test; but facilities were also given to machiners, wholesale merchants and retailers to have their seeds tested at a fee of two shillings per sample. As may be seen from the details in Table II the number of farmers who took advantage of the new service during the early years was greater than the corresponding figure for merchants, but between the years 1916 and 1920 the order was reversed. This change in the source of supplies still continues, and works satisfactorily by virtue of the fact that the machiners and wholesale merchants in general have co-operated with the Department and with the Station by perfecting their cleaning plant, and by having their seeds tested for germination and purity before distribution. The net result of this has been that farmers can now rely to a greater extent than formerly on getting seeds of good quality and, except as an occasional check on the vendor's declaration, the question of having tests made on purchased seed is not so vitally necessary as it was in earlier years.

TABLE II.

Showing the Number and Source of the Samples tested at the Station since 1900.

Year	Farmers	Merchants	Agri-cultural Instructors	Investigations and Miscellaneous	Department's Officers	Seed Acts	Total
1900/01							488
1901/02	-	-	Details not available.			-	
1902/03							712
1903/04	581	209	115	—	141	—	1,046
1904/05	611	336	500	—	89	—	1,536
1905/06	684	204	524	—	66	—	1,478
1906/07	652	128	584	—	96	—	1,460
1907/08	873	175	972	—	147	—	2,167
1908/09	1,038	157	977	-	128	—	2,300
1909/10	1,051	190	—	—	203	498	1,942
1910/11	931	229	—	—	247	682	2,089
1911/12	708	388	—	—	224	788	2,108
1912/13	724	473	—	250	262	866	2,575
1913/14	622	447	—	364	222	1,136	2,791
1914/15	1,386	508	—	131	551	1,140	3,716
1915/16	2,354	853	—	94	638	1,599	5,538
1916/17	2,084	1,804	—	249	910	1,042	6,089
1917/18	6,091	3,596	—	362	913	1,525	12,487
1918/19	2,825	2,320	—	950	556	1,909	8,560
1919/20	1,778	2,486	—	392	369	2,378	7,403
1920/21	853	1,990	—	1,102	346	1,908	6,199
1921/22	590	1,372	—	559	201	1,696	4,418
1922/23*	437	936	—	76	260	1,217	2,926
1923/24	445	1,129	—	1,082	362	1,200	4,218
1924/25	794	1,199	—	890	727	1,432	5,042
1925/26	456	1,207	—	900	462	1,581	4,606
1926/27	462	1,313	—	1,116	485	1,472	4,848
1927/28	643	1,632	—	1,362	444	1,699	5,780
1928/29	742	1,745	—	1,096	406	1,044	4,993
1929/30	565	1,773	-	532	330	1,326	4,526
1930/31	900	1,766	—	660	414	1,474	5,304
1931/32	1,569	1,872	—	702	373	1,397	5,913
1932/33	1,067	1,745	—	656	347	1,402	5,217
1933/34	681	1,953	—	620	315	1,089	4,658
1934/35	907	2,235	—	994	343	935	5,414
1935/36	1,087	2,237	—	686	433	827	5,270
1936/37	2,536	2,184	—	217	464	897	6,298
1937/38	1,502	2,663	—	318	489	1,081	6,053
1938/39	1,601	2,807	—	1,220	520	1,050	7,198

* From this date the official Station for Northern Ireland was in existence.

The advantages of this change in the source of origin of the samples received at the Station is obvious when one considers the relative sizes of the bulks from which the samples are derived. For instance, a farmer's sample may be taken from a few barrels of wheat or a stone of clover seed while it would be nothing unusual for a merchant's sample to represent a consignment of seed wheat amounting to 100 tons, or a parcel of clover seed of two tons, either of which would be sufficient to " seed " approximately

1,000 acres, and might be purchased by 800 different farmers. These are only two instances of what is usual in the seed trade, and provided the wholesaler ensures, by making use of the Station, that the seeds he distributes are of high quality, a single test conducted on his behalf covers the hundreds of smaller lots into which the original bulk may eventually be subdivided and sold.

The small but steady increase in the volume of the work between the years 1914 and 1918 was very marked. This was the direct result of the compulsory tillage campaign inaugurated during the Great War. By 1922-23, however, the number of samples tested at the Station fell to 2,926, the explanation being that the Government of Northern Ireland had then assumed responsibility for seed control in the six counties under its jurisdiction. Consequently, many of the merchants and most of the farmers in these areas no longer sent samples to Dublin, but made use of the Belfast Station which had just been established. Since then the number of samples received for test at the Dublin Station has on the whole shown an upward tendency ; and in recent years the increase has come about largely as a result of the Government's wheat-growing scheme.

The samples referred to in Table II, as being tested on behalf of the Department's Officers are, in the main, made up of seeds used for laying down experimental and demonstration plots, of seeds for relief schemes, and of pureline and other seed cultures raised by the Plant Breeding Division, but none of these call for any special mention.

A relatively large number of tests are grouped together under the heading Investigations and Miscellaneous. Many of these tests were merely check or duplicate tests carried out to confirm earlier results or in connection with seed disinfection trials on behalf of the phytopathological section of the Seeds and Plant Disease Division, as it was then known ; but by far the greater number were conducted with the object of developing a more satisfactory technique in connection with official seed-testing routine. In the early years there was no unified method of approach to this sort of work. Optimum conditions for germinating the various kinds of seeds were either unknown or difficult to reproduce with the apparatus available and rules for seed testing that could be subscribed to by all countries with a seed-control service did not exist. Only by repeated experiments in the laboratory could these gaps in our knowledge be filled, and it is of interest to note that between the years 1924 and 1931 when the International Seed Testing Association was endeavouring to draft common rules to be followed by the Directors of affiliated Seed Testing Stations throughout the world, the results of investigations which had been carried out at Dublin helped, in a great measure, to clarify many of the technical points at issue.

Effect of the Work.

With this as a general background to the volume of work carried out at the Dublin Station we can now examine in some detail its effect on the quality of agricultural seeds available for sowing purposes in Ireland. To do so it will be necessary to take the year 1909–10 as our starting point and review the whole matter in the light of the possible control which Part II of the Weeds and Agricultural Seeds (Ireland) Act, 1909, conferred on the Department of Agriculture and Technical Instruction and on the Station.

Generally speaking the position at that time was extremely bad as regards the quality of seeds available for sowing purposes, but in all fairness it must be said that certain wholesale merchants and retailers were distributing seeds of relatively high standards of germination and purity. This being so the question arose as to how the quality of the low grade seeds could be improved, but before the problem could be satisfactorily approached in practice the principal contributing causes of this general inferiority had to be determined, and it was in this connection that the information obtained at the Station proved to be of great value. Under the terms of the Act official samplers were appointed to inspect stocks and, if necessary, to take samples of agricultural seeds exposed for sale. In this way a great amount of very useful information was obtained from which it became increasingly clear that the general inferiority of the seeds in commerce at that time could be attributed to one or other of the following causes :—

(1) The presence of light or immature seeds and weed seeds in parcels of ryegrass and other seeds of low bushel weight. This arose from imperfect cleaning.

(2) The sale of cleanings from ryegrasses and clovers.

(3) Reduced vitality of seeds owing to their age and improper storage.

The Effect of Imperfect Cleaning.

It is obvious that no amount of machining or other methods of cleaning could make a dead seed germinate, but where a low percentage of germination in a fresh well-harvested sample was due to the presence of light and immature seeds—a common feature in ryegrasses—it followed that the removal of these would improve the bushel weight of the sample, raise its germination, and at the same time improve its purity by removing such light material as the seeds of Yorkshire Fog, chaff and other debris.

In connection with such terms as germination and purity it should be borne in mind that all tests referred to in this report, unless otherwise stated, have been carried out according to what has come to be known as the " Irish Method," which, in short, means that all seeds in a sample of the kind in question, irrespective of their stage of development, are

regarded as pure seeds and are accordingly tested for germination. On the other hand in tests made according to the so-called " Continental Method " light and immature seeds are removed as impurities, consequently the germination tests are carried out with specially selected seeds only. It follows from this difference in method that a sample of Perennial Ryegrass or Cocksfoot seed with a high percentage of light seeds, but otherwise normal, will show a high purity figure and a low germination result according to the Irish Method, while the same sample if tested by the Continental Method will show low purity and high germination figures, but since purity is determined by weight and germination by numbers, the variations in the results will not be compensatory. This is clear from the figures shown in Table III which were obtained from tests made according to both methods on an inferior sample of Perennial Ryegrass seeds :

TABLE III.

Showing the Results of Tests made by the Irish and Continental Methods on a Sample of Perennial Ryegrass Seed of low quality.

Perennial Ryegrass Seed	Purity	Germination
	Per cent.	Per cent.
Irish Method	96.4	54
Continental Method ..	78.8	93

From this Table one can infer in the first place that the sample contained 3.6 per cent. (100—96.4) of impurities which were in all probability made up of weed seeds and debris. Secondly that the sample contained 17.6 per cent. (96.4—78.8) of light or immature Perennial Ryegrass seeds which were removed when making the Continental purity test, and finally that 93 per cent. of the selected-mature seeds that remained were alive. In other words by proper cleaning, which would have removed the light seeds and also a considerable amount of the weed seeds and debris, this very inferior material could have been converted into a high grade sample of Ryegrass seed having an analysis of approximately 93 per cent. germination and a purity figure somewhere in the region of 98 per cent.

The effects of imperfect cleaning on the quality of Ryegrass seeds may also be seen from the figures in Table IV which represent the average percentages of germination and purity of all Perennial Ryegrass samples taken under the Weeds and Agricultural Seeds (Ireland) Act and tested in the Station in 1918. Sufficient data is not now available to enable the question to be examined in as great detail as one would wish, but it may be assumed

with a reasonable degree of certainty that the low bushel weights found in certain cases were due in the first instance to the presence of large quantities of light immature seeds in the samples, which in turn had the effect of lowering the germination figures, and in the second to the presence of considerable amounts of the seeds of Yorkshire Fog and other impurities which are revealed by the gradual reduction of the purity figures.

TABLE IV.

Showing the Average Germination and Purity Figures obtained for all Samples of Perennial Ryegrass Seed taken under the Weeds and Agricultural Seeds (Ireland) Act, 1909, and tested in 1918.

Bushel Weight	Average per cent. Germination	Average per cent. Purity
lb.		
28	83	97.6
26	73	95.0
24	65	96.2
22	60	93.0
20	57	92.1
18	47	89.2
16	41	83.2
14	35	82.1
12	27	74.8
10	14	67.4

In connection with the details which appear in Table IV it is questionable if all the various grades referred to were really natural growth products at all. In fact one would be inclined to suggest that seeds of the lower bushel weight, were largely made up of the cleanings from better quality Ryegrasses and put on the market as "White Hayseed." If we apply the lesson to be learned from Table III to those bulks whose bushel weights were 20 lbs. or over it is clear that they could have been greatly improved by suitable cleaning and converted into seed of reasonably good quality; but with regard to the materials of the lower bushel weights which varied from bad to worthless it is difficult to see how cleaning could have any marked beneficial effect on them.

"HAYSEED" AND "WHITE HAYSEED."

To get an accurate idea of what these low grade "Hayseeds" were like

one must examine the results of a detailed analysis as carried out in the Station, and, in this connection, a sample of seed which was taken in 1918 on the premises of an Irish seed merchant, who offered it for sale at two shillings per bushel, will serve as an illustration of what was, in all probability, the sweepings from a hayloft. A case may be made, from the point of view of mass seed-selection, for using hayloft seeds from first-crop hay of good quality; but as may be inferred from the analysis of the seed in question the hay from which it came must have been very inferior. Of the total weight of the seed only 62.55 per cent. consisted of pure seeds of agricultural value, such as Perennial and Italian Ryegrass, while the remaining 37.45 per cent. of the sample consisted of the seeds of weeds and debris. Figures like these, however, give a very imperfect picture of the true state of affairs, but by advancing the test a stage further the worthless and positively harmful nature of such material can be seen at a glance.

Table V contains a list of the different kinds of weed seeds present in this particular sample, and also the approximate number of seeds of each to be found in every pound weight of the bulk. From this it emerges that each pound of the "Hayseed" contained in the region of 150,000 seeds of Ryegrass and 190,000 weed seeds, and to make matters worse only 55 per cent. of the Ryegrass seeds were alive and capable of germination under laboratory conditions.

TABLE V.

Showing the Kind and Estimated Number of Weed Seeds in each Pound of a Sample of "Hayseed" taken on the Premises of a Retail Seed Merchant in 1913.

Kind	Number of Seeds per lb. of Sample	Kind	Number of Seeds per lb. of Sample
Yorkshire Fog ..	72,640	Picris	227
Sheep Sorrel ..	49,032	Sowthistle ..	227
Brome Grass ..	1,589	Cat's Ear ..	681
Buttercup ..	8,172	Common Daisy ..	4,086
Crepis	19,976	Chickweed ..	3,178
"Hairgrass"	5,675	Aira sp. ..	4,540
Plantain	3,405	Mustard	681
Suckling Clover ..	7,264	Scirpis	227
Ox-eye Daisy ..	908	Woodrush ..	2,497
Sweet Vernal ..	454	Forget-me-not ..	2,724

With the information contained in Table V at our disposal and assuming that the bushel weight of the material was 10 lb. and its price 2s. per bushel it follows that the purchaser, who probably thought he had got a bargain, was in reality paying at the rate of 9d. per lb. for pure germinating Ryegrass seeds at a time when the best quality seeds of these grasses were freely offered at 8d. per lb. A transaction like that is undoubtedly bad business especially when it is borne in mind that if two bushels of this material are sown per statute acre, weed seeds are actually sown at the rate of 1,000 per square yard.

As may be inferred from this illustration, the sale of "Hayseed" or the sweepings from haylofts was a most iniquitous system, especially where the hay was of inferior quality, but the sale of cleanings from Ryegrass seeds was infinitely worse. This will be obvious from the following details which refer to a fairly typical sample of "White Hayseed" that was taken on the premises of a seedmerchant in the West of Ireland :

Pure seed (Perennial and Italian Ryegrass)	21.85	per cent.
Injurious Weed Seeds	27.75	,,
Other weed seeds and debris	50.40	,,

Each pound weight of this material contained some 400,000 weed seeds and approximately 50,000 seeds of agricultural value, but the germination of the latter was only 58 per cent. Use of this material at the rate of two bushels per statute acre would result in the sowing of approximately 1,600 weed seeds and 200 Ryegrass seeds per square yard ; but as the germination of the latter only reached 58 per cent. under optimum conditions, its germination in the field would certainly not exceed 20 per cent., and furthermore, the majority of the young seedlings that might appear would soon be smothered by the developing weeds. Here again the false idea of cheapness is shown by the fact that the small amount of pure germinating Ryegrass seeds present in this sample cost the purchaser about 1s. 8d. per lb. or approximately six times their market value.

Cleanings from Clover Seeds.

The cleanings from clover seeds reached this country from outside sources and in its own way this material was quite as bad as the grass-seed cleanings that were produced at home. At this time few retail seed merchants or farmers in the West of Ireland could identify the various clover seeds or their impurities, and if the weed seeds present in such samples were approximately similar in size and colour to the clover seed themselves they generally passed unnoticed. The nature of one of these samples becomes clear from the following details which refer to a sample of seed that was

offered for sale in this country as White Clover though more than one half of its weight was composed of weed seeds and debris.

Pure White Clover seeds ..	21.55 per cent.		Germination 28 per cent.
Other seeds of agricultural value	27.91	,,	
Weed seeds and debris ..	50.50	,,	

The weed seeds present in this sample belonged to twenty-two different kinds of plants, and amounted in all to approximately 500,000 in each pound of the so-called White Clover. In other words if this material was sown at the ordinary rate of 2 lb. per statute acre, weed seeds would be sown at the rate of 200 per sq. yard, and the resulting plants would almost certainly smother the few clover seedlings that might make their appearance. As in earlier examples the cheapness of this seed may have been the possible attraction, but its cheapness is more apparent than real since the pure germinating seed which it contained actually cost 10s. per lb. or five times the market value of White Clover seed of the highest quality.

The Sale of Old Seeds of Low Vitality.

Experiments carried out at the Department's Station and elsewhere on the longevity of agricultural seeds proved that when seeds of high quality were stored under dry and cool conditions the fall in the percentage of germination was comparatively small for the first year or so, but after that time the germination dropped rapidly and reached zero in most cases when the seed was about ten years old. In the early years of seed control work in Ireland good storage conditions were not always available on the premises of retail seed merchants, and bulks of seed left unsold at the end of the season were often kept over the winter in damp stores under conditions that could only result in a rapid loss of vitality. As a rule fresh seeds were procured the following year, and if these were disposed of early, the old stocks were worked off at cut prices: but it often happened that these seeds were kept in storage for several years and were absolutely worthless by the time they were sold. This is abundantly evident from the analysis of various samples of seeds taken on the premises of retail seed merchants during the years immediately following the introduction of the Weeds and Agricultural Seeds (Ireland) Act, 1909. Judged by their purity figures these seeds were probably quite good when new; but, as may be seen from Table VI, they were for all practical purposes dead at the time of sampling.

TABLE VI.

Showing the Low Vitality in Old Seeds sampled under the Weeds and Agricultural Seeds (Ireland) Act, 1909.

Kind of Seed	Germination	Purity
	Per cent.	Per cent.
Perennial Ryegrass ..	2	98.65
Italian Ryegrass ..	0	96.4
Cocksfoot	19	99.5
Meadow Fescue ..	3	99.25
Timothy	6	99.25
Red Clover	2 ; 1 hard	97.0
Alsike Clover ..	1 + 2 ,,	99.0
Rye	9	99.29
Mangel	6	99.34
Turnip	6	99.27
Swede . ..	15	99.83

Working of the Weeds and Agricultural Seeds (Ireland) Act, 1909.

The distribution of imperfectly cleaned seeds, loft sweepings, "White Hayseed," clover screenings and old seeds shows the weak points in the business methods of the Irish seed trade about the time Governmental control was undertaken, though as previously mentioned several wholesale and retail seed merchants were handling agricultural seeds of relatively high quality. Enormous quantities of very inferior seeds were on offer and freely bought by farmers throughout this country, and it was only by making full use of the powers conferred under the Act that this worthless material was finally driven off the Irish market.

Under the terms of the Act, Inspectors of the Department of Agriculture and Instructors in Agriculture were appointed official samplers, and each year during the months of February, March, April and May they inspected the premises of seed merchants in their districts and took sealed samples of the seeds exposed for sale there, which they forwarded to the Station, leaving with the vendor duplicate sealed samples. Before these samples were tested the general average quality of the seeds available in that year was determined from samples sent voluntarily by merchants and farmers, and in this way standards of quality were set with which the samples taken under the Act were afterwards compared. The standards of germination

and purity, for the kind of seed in question, were always set well below the corresponding average figures obtained in a particular year, and they generally varied from year to year depending on the quality of the seeds available.

When the samples taken under the Act were tested and the results compared with the standards for that year the vendors of unsatisfactory seeds were advised of the results of the tests made of their seeds and further portions of the working samples in question were forwarded to each. In this way a merchant whose seed did not come up to the required standard of purity and germination held two samples of the bulk in question which he could have tested at any Station in the world as a check on the official results, but such check tests were very rarely resorted to. In the case of a first offence the retailer from whom the seeds were taken, as well as the wholesaler who supplied them, received an official warning, and both were advised to make greater use of the seed testing service in future; but in the case of a second or subsequent offence the names and addresses of the retailer and the wholesaler who supplied the seed in the current year, together with the germination and purity figures, were published in the form of "Black-lists" and circulated to some 5,000 vendors of agricultural seeds throughout the country. The use to which these lists were put by a recipient depended entirely on whether his own name or that of his local competitor appeared on it, but in either event the information contained in these "Black-lists" soon reached the farmers in the district. In an extremely bad case, or in a case where a merchant persisted in the sale of inferior seeds after a warning had been given or after his name had appeared on a "Black-list," the details concerning his unsatisfactory seeds were publicly posted in the vicinity of the town in which he did business, and this rather drastic action generally had the desired effect.

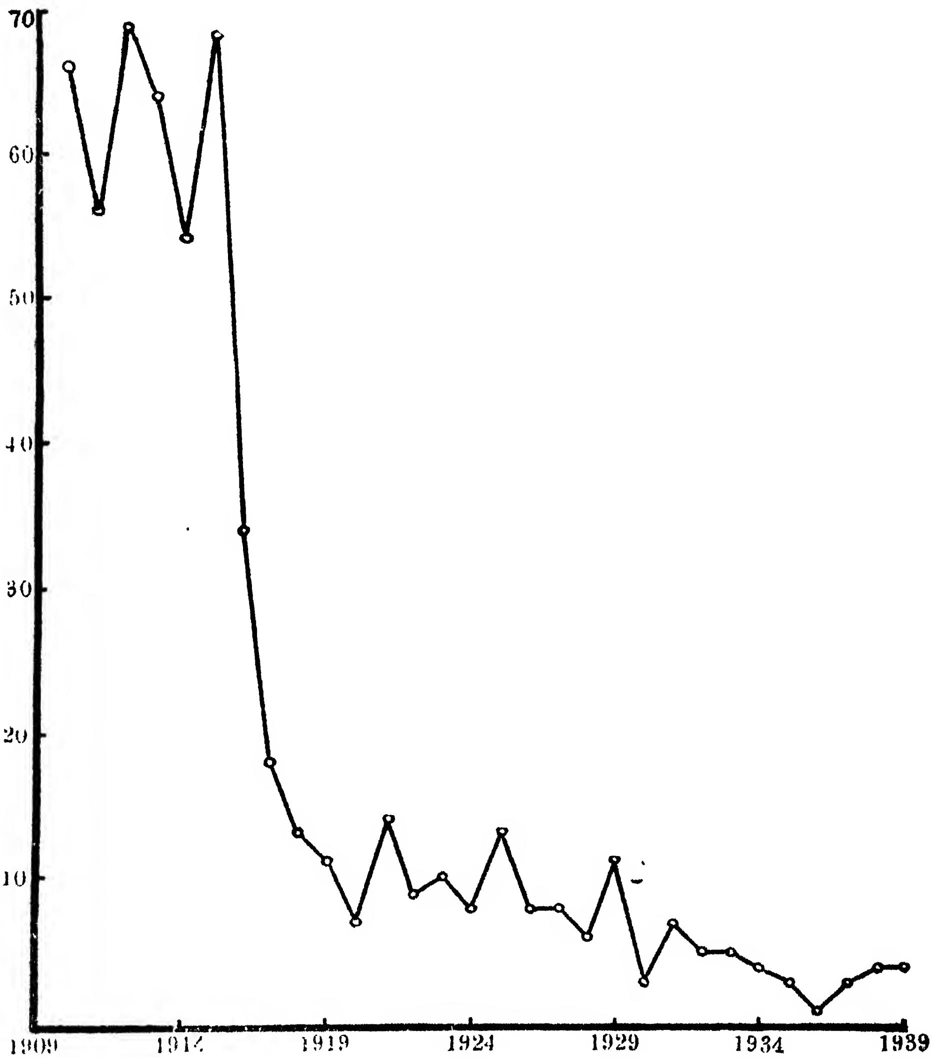
During the early years of the working of the Act the position was seen to be so bad that in January, 1912, a conference was called between representatives of the seed trade of Ireland and officers of the Department of Agriculture and Technical Instruction. At this conference the work of the Seed Testing Station was explained in detail and the state of the trade, as revealed by the samples taken under the Act, frankly discussed. No formal decision was arrived at, but in July, 1913, matters came to a head when the Irish seed cleaners and merchants held a meeting in Belfast and passed a resolution in the following terms:

> "That we seed cleaners and merchants hereby agree as testified by our signatures hereto not to sell from this date for use as agricultural seeds in Ireland any White Hay, Brown Hay, Cleanings, Blowings, Holcus (or articles of similar description) or Perennial Ryegrass under 20 lbs. per bushel or Italian Ryegrass under 16 lbs. per bushel."

This was a very satisfactory step in the right direction, and it was followed

PERCENTAGE OF UNSATISFACTORY SAMPLES.

Fig. 1—Showing the annual percentages of unsatisfactory samples of agricultural seeds tested under the 1909 and 1936 Seed Acts.



by a later agreement, signed in Belfast in September, 1915, whereby the Irish seed cleaners undertook to carry out the terms of the foregoing resolution and at the same time to raise the minimum bushel weight of Perennial Ryegrass from 20 to 24 lb., and of Italian Ryegrass from 16 to 18 lb. No further formal agreements have been signed since that time, but improved cleaning machinery and trade competition have combined to raise the bushel weights to 28 lb. in the case of Perennial Ryegrass and to 22 lb. in the case of Italian Ryegrass.

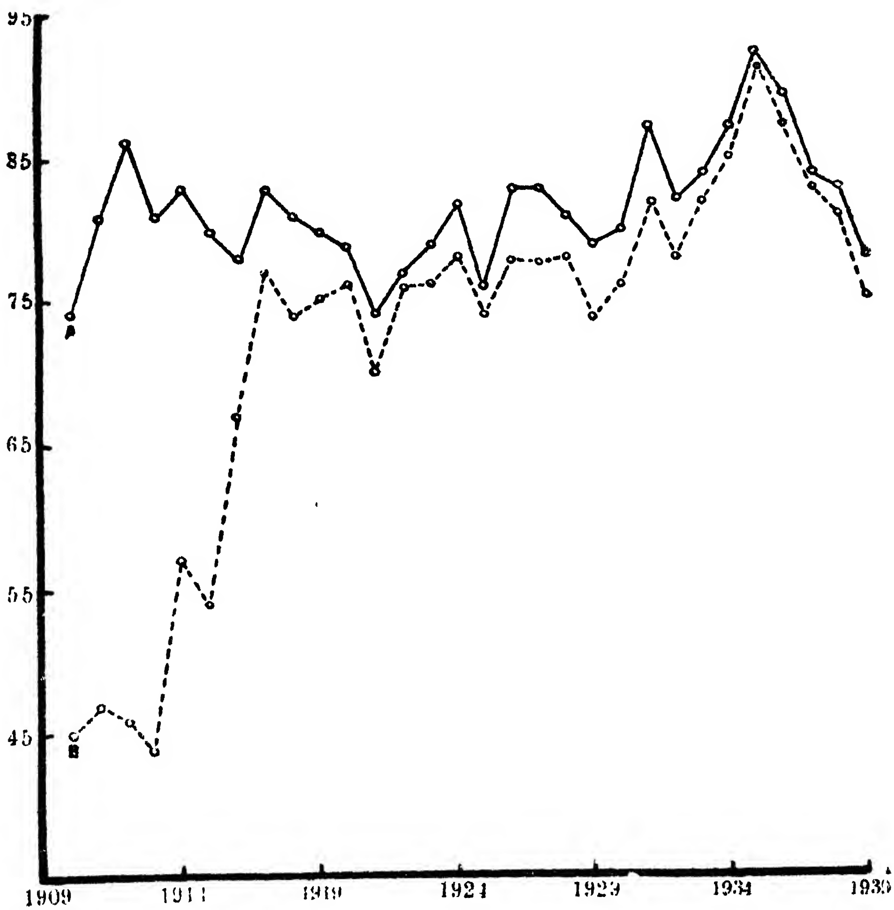
EFFECTS OF THE WEEDS AND AGRICULTURAL SEEDS (IRELAND) ACT, 1909.

From what has been said it is possible, in the first place, to get a fairly accurate idea of the very inferior quality of much of the agricultural seeds that were used in Ireland in the early part of the present century, and secondly to arrive at a definite opinion as to the main causes that were responsible for this inferiority. Finally the controlling machinery that was set in motion in 1909 to effect the necessary cure has been briefly described, and in the remaining part of this article it is hoped to show that this machinery has been completely successful.

In the year 1910 out of a total of 498 samples of seeds taken under the Act, 327 (or 66 per cent.) were found to be most unsatisfactory, in fact the majority were described as "atrocious," and that in a season when the comparative standards for germination and purity were very low. By 1911 the figure for the unsatisfactory samples had dropped to 56 per cent., but this improvement was not maintained, and in 1912 it rose again to 69 per cent. This is the highest figure ever recorded, and means that of every three samples taken under the Act in that year two were either very inferior or worthless For the next two years the figure dropped, but by 1915 it was back again at 68 per cent. From that time onward, however, a rapid and sustained improvement set in, and in the year 1936 when 827 samples of seeds were taken and tested under the Act only 1 per cent. of these was found to be unsatisfactory, even though the comparative standards for germination and purity were relatively higher in that year than those in operation from 1910 to 1915. Though these results show the present state of affairs, with regard to the quality of the seed available for sowing purposes, in a very favourable light the position is in reality even better than the figures would indicate. In the early years of this work the official samplers did not necessarily pick and choose the bulks to be sampled, but took samples more or less indiscriminately without reference to their probable quality as judged by a naked eye examination, while in recent years the majority of the samples taken under the Act and forwarded for test have been more or less specially selected on account of their appearance, their age, or for some other reason. Had such a system been in force from 1910 to 1915 it follows that the percentages of unsatisfactory samples would have been considerably higher than are shown for those years in Fig. 1.

TRUE VALUES $\left(\frac{P \times G}{100}\right)$

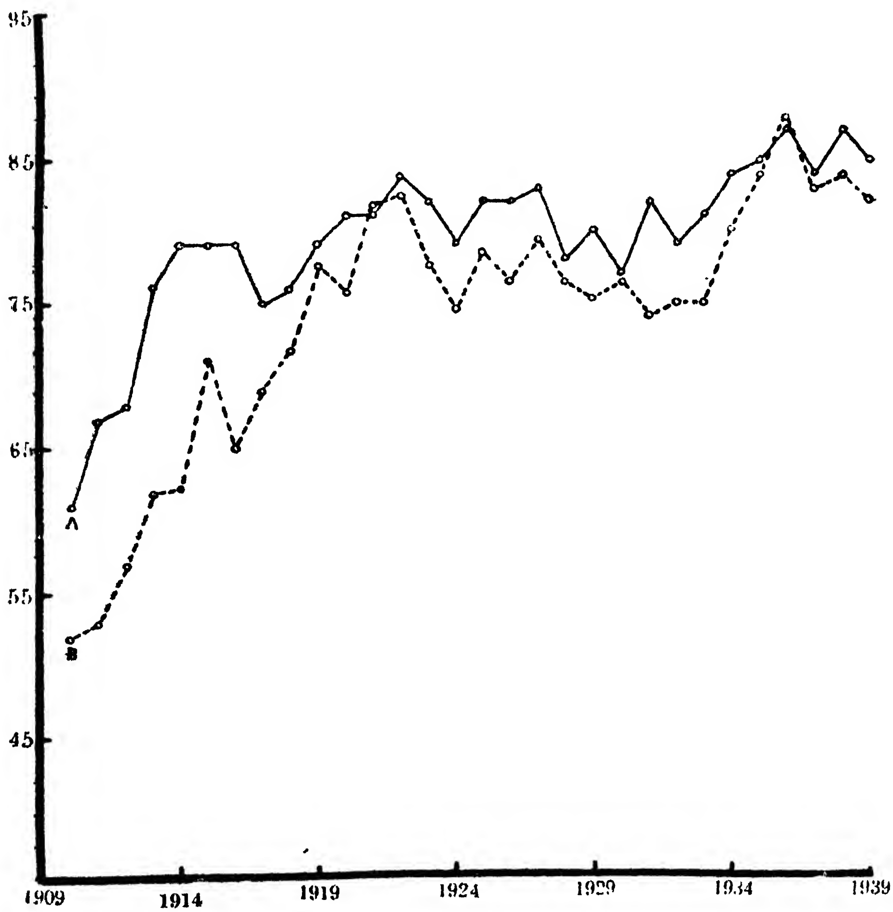
Fig. **2—Showing the average " true values " for samples of Perennial Ryegrass Seeds tested for merchants and farmers and for samples taken under the 1909 and 1936 Acts**



A—Samples sent by merchants and farmers.
B—Samples tested under the Seed Acts.

TRUE VALUES $\left(\frac{P \times G}{100}\right)$

Fig. 3—Showing the annual average "true values" for samples of Cocksfoot Seeds tested for merchants and farmers and for samples taken under the 1909 and 1936 Acts.



A—Samples sent by merchants and farmers.
B—Samples tested under the Seed Acts.

While the illustration referred to gives a general picture of the almost complete disappearance of inferior seeds from the Irish market this becomes more evident from an examination of the gradual improvement shown in the quality of the different kinds of seeds taken annually under the Act. Of the examples selected some, like the Ryegrasses, are produced at home; Cocksfoot and White Clover seeds are usually imported from the Continent; while the stocks of Mangel seed used in this country are largely raised in England.

Strictly speaking, the "quality" of a sample of seed depends on a number of factors as, for instance, its vitality, its purity, the nature of the impurities. its strain and source of origin, the presence or absence of seed-borne disease organisms and so on, but for the purpose of these illustrations it will be sufficient to confine our attention to a consideration of the germination and purity figures alone, and calculate what is known as the "true value" or "relative worth" of the seed :—$TV = \frac{P \times G}{100}$. In the accompanying graphs the average annual true values for the seeds in question are plotted against the year of test and each graph shows the position with regard to seeds sent voluntarily for test and to those taken under the Seed Acts.

As may be seen from Figs. 2, 3, 4 and 5, the quality of the seeds sent voluntarily for test by merchants and farmers in the early years of the Station's activity was relatively poor; but the upward tendency of the curves, which reveal expected annual variations, shows that on the whole a steady improvement has been maintained right through the period under review. As was to be expected the corresponding curves prepared from the data obtained from samples taken under the Seed Acts started at much lower levels in 1910; but again, owing to the rapid improvements that took place in the seed trade, these curves rose rapidly, generally remaining immediately below, but in some cases actually touching higher points than the corresponding curves representing the quality of the samples sent voluntarily. Instances of this may be seen in the case of White Clover samples taken in the years 1919, 1921, 1922 and 1924; of the Mangels taken in 1920, 1921, 1923, 1927 and 1930; and of the Cocksfoot seed taken in 1921 and 1936.

The improvement shown in the quality of the seeds mentioned here may be regarded as typical of what has taken place in the case of most of the other agricultural seeds used in this country. Of the imported field crop seeds, however, flax, swedes and turnips show least change and for the simple reason that there was less room for improvement in the case of these seeds which, on the whole, were always of fairly good quality. Their purity was, as a rule, high, and provided the stocks were fresh the germination figures rarely dropped to the low levels frequently found in the case of grasses and clovers.

Cereals.

With the exception of the past few years, when a considerable quantity of seed wheat of high quality was imported into this country to meet the demands arising from the Government's Wheat Scheme, the supply of cereal seed has been produced at home. At one time small amounts of oats of Scottish origin were imported as foundation stocks by way of a "change of seed" but generally speaking the Irish farmer saved his own cereal seeds for sowing purposes and, in the case of oats especially, he showed himself to be a very shrewd judge of quality which he correctly correlated with the weather conditions experienced at harvest time. From the annual records it is abundantly clear that as a rule seed oats, wheat, barley and rye are of high quality following a dry and sunny harvest, and in such years farmers do not use the Station to the same extent as when the harvesting conditions have been unfavourable, and the quality of the seed is suspect. As may be seen from Figs. 2, 3, 4 and 5 the effect of seasonal variations is not confined to Cereals, and in Table VII this feature is revealed in a rather striking manner for wheat, oats, barley, rye, perennial and Italian ryegrass seeds that were sent voluntarily for test.

TABLE VII.

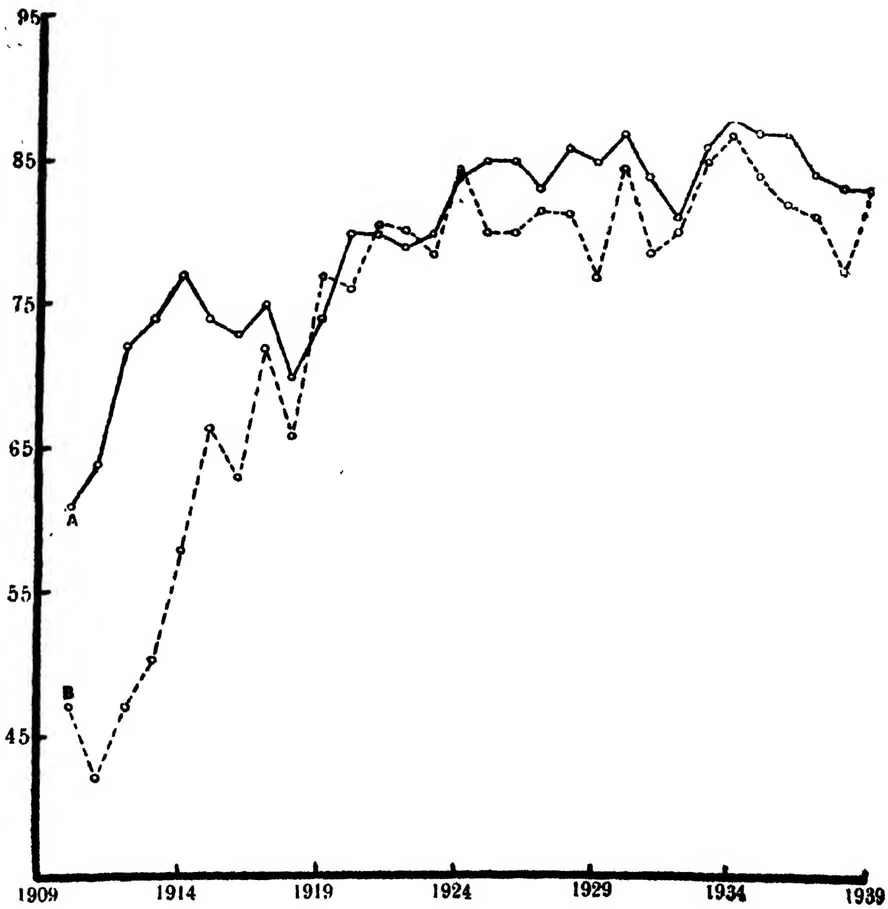
Showing Variation in the Average Germination Figures obtained for certain Seeds following good and bad Harvest Years.

Seed	Average Percentage of Germination for Harvest Years				
	1908	1911	1924	1934	1938
Wheat	61	93	79	93	85
Oats	83	91	88	90	86
Barley	79	97	88	94	87
Rye	68	91	76	86	81
Perennial Ryegrass	72	89	80	94	75
Italian Ryegrass	68	85	81	90	73

With regard to these results one cannot be absolutely sure that all the samples of seed used in the preparation of the average germination figures were grown in Ireland; but we can be reasonably certain, at least, that they were produced in the British Isles where weather conditions were more or less similar in the years referred to. At this distance in time the writer cannot speak with certainty as to the kind of weather that prevailed prior to and during the harvest of 1908, but from the quality of the seed obtained in that year it would appear to have been unsuitable for seed saving. On

TRUE VALUES $\left(\frac{P \times G}{100}\right)$

Fig. 4—Showing the annual average " true values " for samples of White Clover Seed tested for merchants and farmers and for samples taken under the 1909 and 1936 Acts.

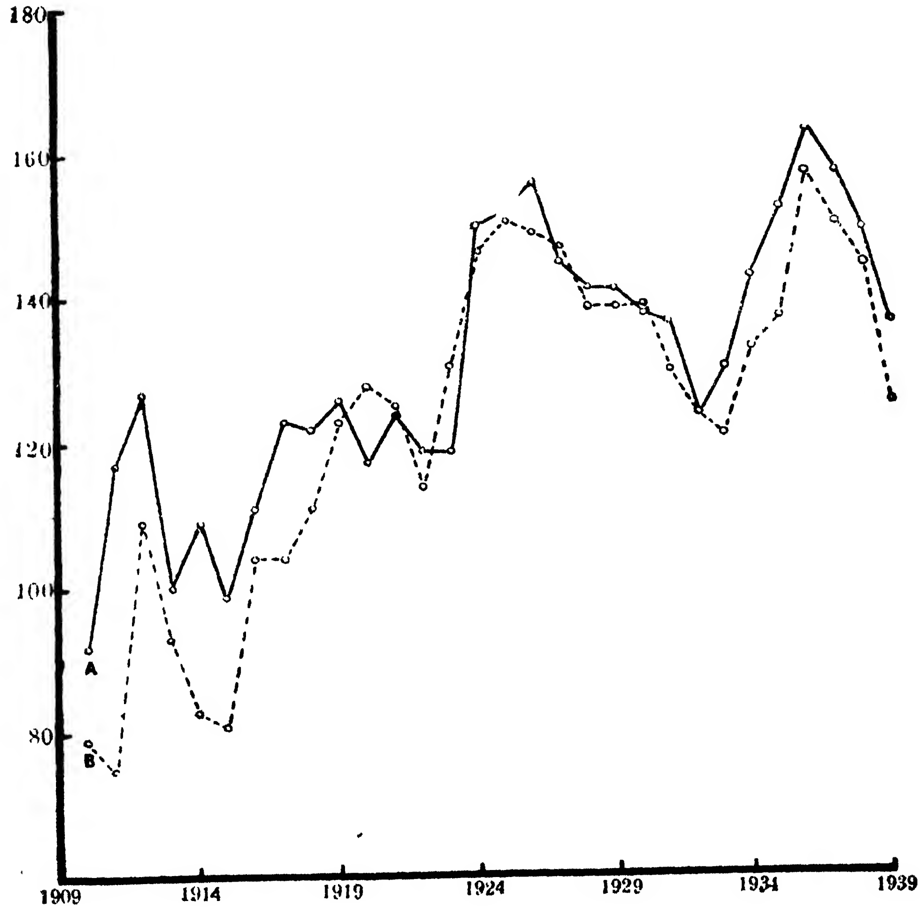


A—Samples sent by merchants and farmers.
B—Samples tested under the Seed Acts.

TRUE VALUES $\left(\frac{P \times G}{100}\right)$

Fig. 5 - Showing the annual average "true values" for samples of Mangel Seed tested for merchants and farmers and for samples taken under the 1909 and 1936 Acts.

Calculations are based on total seedling production, which usually exceeds 100%.



A—Samples sent by merchants and farmers.
B—Samples tested under the Seed Acts.

the other hand the summer and autumn of 1911 were particularly favourable for seed production, and as a result the quality of the seed harvested in that year was exceptionally good. It might appear at first sight that the improvement noted in 1911 was the direct result of the new Seed Control programme; but as may be seen the seeds tested after the unfavourable harvest of 1924 show a very considerable drop in quality while the good effects of the 1934 season are shown by the high quality of the seeds saved in that year. The wet and sunless summer of 1938 will long be remembered and the disastrous effect which it had on agricultural seed production is clearly shown in the last column of Table VII.

Results like these show the futility of attempting to set arbitrary standards of germination for the various kinds of agricultural seeds at the beginning of a seed year, say in the month of September. These must of necessity vary from year to year depending on weather conditions in the different seed producing countries, and it is only towards the end of the sowing season that one can say with any degree of certainty what the quality of the seed available has been in that year. By making use of this information as a basis for evaluation it is then possible to set standards with which the samples already taken under the Acts may be compared. In early spring very frequently seed merchants ask to be informed of the minimum standards allowed for the germination of the various kinds of agricultural seeds, but since no standards are fixed at that time the only advice one can give to such an inquiry is that the merchant should fix his own standard of quality by purchasing nothing but the best seed procurable.

Conclusion.

In attempting to outline in this short article the value of scientific seed control and what it has accomplished in Ireland during the past thirty years many points of interest have of necessity been omitted. For instance no mention has been made of the work done at the Station in connection with the identification of seed-borne disease organisms, their dissemination and control, or of investigations that have been carried out concerning the source of origin of agricultural seeds; but these and other questions have received a considerable amount of attention as occasion arose. This note is primarily intended to throw some light on the germination and purity of the agricultural seeds available to the Irish farmers in the early years of the present century, and to compare the state of affairs that existed then with the position as it is to-day. Evidence has been produced to show that while a certain amount of relatively good seed was always on the market for those who were prepared to look for it and to pay the price asked, much of the grass seeds produced at home as well as some of the imported seeds were useless for sowing purposes but were, nevertheless, bought and sown in the poorer parts of the country. To-day, however,

as a result of the Department's Seed Control service, coupled with more enlightenment on the part of the farmers themselves. and with the co-operation of the members of the Irish seed trade, all that has changed. Such worthless material as old seeds of low vitality, "Hayseed," and the screenings of grasses and clovers have for all practical purposes disappeared, with the result that Irish farmers in the most backward parts of the country can procure the best agricultural seeds in the world, provided they make full use of the service which has been placed at their disposal.

THE EFFECT OF FIBRE AND "BULK" IN THE DIETARY ON THE PROGRESS OF CHICKENS AND ON THE PREVENTION OF FEATHER PICKING AND CANNIBALISM.

BY

E. J. SHEEHY, D.Sc., F.R.C.Sc.I., and E. M. BURKE.
Animal Nutrition Department, University College, Dublin.

(I). INTRODUCTION.

The chemical constitution of the dietary of chickens has proved so alluring that investigators have given less attention to the mechanical aspect of the problem, *i.e.*, the physical effect of the food on the alimentary tube. In a general paper arising out of work done principally on pigs and dealing with this aspect of nutrition the writer (1) pointed out that the clashing of opinion which sometimes marked the contentions of the scientist and the practical feeder was due to the ignoring, by the former, of the physical effects of food constituents: he also referred to the possibility of arriving at fallacious conclusions from experiments in which only the supply of proteins, minerals, vitamins, water and energy was taken into account. Since then a series of experiments have been conducted on chickens so as to relate some of the general statements of the earlier paper to the specific case of poultry, and to investigate the question of "bulk" and fibre of different kinds on chicken growth and behaviour.

(II).—PREVIOUS WORK.

Practical feeders from their own observations have come to adopt feeding practices which usually give satisfactory and frequently give excellent results. The practices are empirical however. The scientist on the other hand constructs step by step, as new knowledge is discovered, the framework of a complete dietary. While unfinished this scientific framework may not be in agreement with many of the ideas of the empirical feeder. Indeed, owing to the pitfalls in experimental technique, data from different sources do not always agree, yet the accumulation of new facts by successive workers enables the scientific viewpoint to prevail.

The contributions to our knowledge of "bulk" and fibre in poultry nutrition come from many countries. Rhys (2) working with growing pullets and laying hens obtained similar results from maize when fed as meal and as the more bulky flakes. From experiments on digestibility many workers (3) have determined that fibre

is very poorly utilised by poultry. Coarse and semi-lignified fibre is not digested at all, while that in the common feeding stuffs is digested to the extent of 10 to 15, and in a few cases, to 20 per cent., of that present. Fibre *per se* added to a dietary does not depress the digestibility of the other constituents and merely acts as a diluent but in the case of fibre forming an intrinsic part of the foods used it has been shown to have a depressing effect so that the digestibility of the other organic constituents of a high fibrous food is less than that of one whose fibre content is less. Morris, Thompson and Heller (3) found that notwithstanding the addition of ground oat hulls and alfalfa stems to a feed mixture, thereby raising the percentage of fibre in the mixture from 3 to 10 per cent., the growth rate of chicks on the comparable mixtures was more or less alike when the food consumption was similar. Tomhave and Mumford (4), however, considered 7 per cent. of fibre in the dietary excessive in experiments in which the fibre was altered by changing the proportion of cob corn meal. At Oklahoma Experiment Station (5) when the dietary of chickens was made more fibrous by the addition of ground cotton burrs and peanut hulls there was little effect on health and rate of growth till 10 per cent. was exceeded. When Miller, Waynt and Bearse (6) increased, by adding oats, the fibre content of a chick dietary to 8 per cent. the food efficiency was reduced so that the optimum of fibre had been exceeded. Working with fattening chickens Cruickshank (7) found Sussex ground oats and milk a superior ration to ground barley or ground maize and milk. Presumably the Sussex oats contained more fibre than barley or maize. One of the present writers (E.J.S.) in a paper to the Fourth World's Poultry Congress (8) on the other hand, appeared to show that a concentrated dietary containing only 4.8 per cent. of fibre gave better production than more bulky dietaries in which the fibre content rose to 5.4, 6. and 6.8 per cent. A study of the results of these tests, in which cod liver oil was not fed, would indicate that the superiority of the more concentrated mixtures was due to their greater carotene content, arising from the higher proportion of yellow maize in these mixtures. Shaw and Fisher (9) who measured the bulk of meal mixtures fed to poultry drew attention to the necessity for taking the volume of the steeped rather than the dry meals.

Information regarding "bulk" and fibre is frequently forthcoming from experiments conducted for the purpose of comparing certain feeding stuffs. Roberts and Carrick (10) got evidence to show that in an otherwise concentrated mixture 30 per cent. of oats was equal to 15 per cent. each of wheat bran and wheat middlings for chickens. They express the opinion that the fibre in a chick ration could be increased to 8 or 9 per cent. without harmful effect on rate of growth or mortality. Experiments conducted in Northern Ireland (11) gave evidence of better winter egg production on a mixture of pollard (4 parts), wheat bran (2 parts), maize (2 parts), Sussex ground oats (1 part), suitably supplemented by minerals and proteins, than on a more concentrated mixture similarly supplemented and comprising

pollard (4 parts), maize (3 parts), and Sussex ground oats (1 part). Fangauf (12) claims that in view of the short food tube of poultry large quantities of bulky foods such as bran and oats may be fed without hampering production. Kennard (13) reports on the definite advantage in the case of laying fowl of adding oats to a concentrated ration. Newman (14) who conducted some pioneer tests on this aspect of poultry nutrition and who is convinced of the importance of bulk repeatedly declares in favour of a high proportion of bran in the ration of chicks, growing pullets and laying stock. Taylor and Lerner (15) bring forward evidence in favour of wheat bran in the dietary of chickens and growing pullets.

Newman also makes reference to the advantage of wheat bran from the point of view of feathering. Of course feathering is affected by many factors. Thus Platt and Geircke (16) found that lots of chicks on a high protein mash feathered better than comrades on a low protein dietary. One of the present writers (E. J. S.) had similar experience with chickens used in another investigation now in progress. The picking of feathers as a prelude to cannibalism is, however, to be distinguished from feather growth. Morris, Thompson and Heller (3) had considerable trouble with feather picking and attempted cannibalism in the case of chickens eating concentrated dietaries containing 3.1 and 5.1 per cent. of fibre respectively. When the mixture was made more bulky by the addition of more fibrous foods feather picking was less in evidence. In tests at Purdue (17) it was noted that chicks on rations containing bran and middlings were much better feathered at ten to twelve weeks of age than those on rations containing comparable quantities of oats or wheat. An observation is recorded in " Eggs " (18) that the feeding of green food and swedes checked feather plucking. Millar and Bearse (19) credit oats and oat hulls with cannibalism-preventing properties. Because the ash from the oats or from the hull does not inhibit cannibalism it is concluded that the particular merit of the hull of the oat in this respect lies in some ingredient other than the ash which it contains. They state that sawdust has no effect in the prevention of feather picking, from which it may be inferred that the potent agent is not fibre. Examination of their results, however, shows that at the age of fourteen weeks and again at thirty-two weeks the percentage of birds which feather-picked on the corn ration supplemented by sawdust is very small in comparison with the percentage of those which feather-picked on the corn ration not so supplemented.

(III). - EXPERIMENTAL PROCEDURE.

Ten days-old White Wyandotte chicks, which had been on a good rearing mash from hatching, were used for the test. The chicks were kept in houses in which the floors were made of a combination of wood slats and wire netting. Each group was confined to an area of 55 square feet. An oil-

burning Hover was used to heat each lot and the sleeping quarters were bedded with wood shavings for the first two or three weeks of test, after which no bedding whatsoever was used. Chicks do not pick at wood shavings to any appreciable extent prior to the age of four or five weeks; but after that period litter of any kind may be consumed to such an extent as to interfere with experimental feeding. Individual weighings were made at intervals as well as at the termination of each experiment and observations were made throughout. The food consumption per lot per week was recorded, and from this and the number of chicks responsible for the food consumption each week the average weight of food consumed per chicken each week throughout the test, and consequently the total per individual for the period of the test, were determined. Except in one or two cases the meal mixture was presented to the chickens in the form of dry mash, and this together with water, which was the only fluid supplied, was before the birds at all times.

(iv).—EXPERIMENTS AND RESULTS.

The following is an outline of the experiments performed and the results obtained:

Exp. A.—*To Compare the Effects of Maize Meal, Wheat Bran (Flake form) and Wheat Bran (ground to Meal).*

Three groups (forty-one chicks in each) were placed on the following dietaries.

	Group 1	*Group* 2	*Group* 3
Cod liver oil	1	1	1
Ground limestone	1	1	1
Common salt	½	½	½
Separated milk powder	4	4	4
Meat meal	8	8	8
Pollard *	26	26	26
Maize meal (yellow)	60	25	25
Wheat bran (ordinary flake form) ..	0	35	0
Wheat bran (ground into meal) ..	0	0	35
Fibre (per cent.) ..	2.7	5.6	5.6

* This refers to wheat offals and consists of the wheat grain less the white flour and bran

Practically all the chicks survived, and the final weights after ten weeks' test were as follows :

			Average Weight	
			lb.	oz.
Group 1	23 Cockerels	..	2	12½
	17 Pullets	..	2	6
Group 2	20 Cockerels	..	2	11
	20 Pullets	..	2	5
Group 3	20 Cockerels	..	2	14
	18 Pullets	..	2	9

The following amounts of food were consumed :

	Group 1	*Group* 2	*Group* 3
	lb.	lb.	lb.
Per chicken in ten weeks	10¾	11¼	10¾

During a period of fourteen days, *i.e.* in the sixth and seventh weeks of life, the water consumption per chick per day was determined to be as follows :

Group 1	*Group* 2	*Group* 3
oz.	oz.	oz.
2	3.1	3.1

The fæces of Groups 2 and 3 were bulky and soft, while those of Group 1 were comparatively much denser and drier, and this fact together with the difference in water consumption between Groups 2 and 3 on the one hand and Group 1 on the other is related to the presence or absence of bran in the dietary.

Luckily, for the purposes of comparison, the food consumption of the three groups was more or less alike : the experience of other tests would indicate that if pollard were omitted from the mixture Group 1 would have eaten less food than 2 or 3. The weight record shows that wheat bran when included in the proportions used in this test and in the particular mixture employed is equal to maize meal in nutritive value.

While the calorific or energy value is appreciably less than that of maize, nevertheless to the chicken the mixture containing bran is as nutritive as the maize one, that is to say, a ration of lower energy value is equivalent, as judged by the progress of the bird, to one of higher value. This is in

keeping with results obtained on other animals by one of the writers and on birds by other experiments. The third group was included so as to determine whether the specific effect of wheat bran was in virtue of its flaky condition, and the results show that in the case of chickens this is not so. Actually Group 3 grew more uniformly than either of the others and at the end of the experiment looked a better lot of chickens. On the average they were heavier, but in view of the numbers, not significantly so. A possible superiority of Group 3 over Group 2 may conceivably be explained by the fact that, in the ration of 3, the bran was more intimately mixed with the other ingredients than was the case in Group 2 ration. Anyhow Group 3 did at least as well as 2 even though the bran was, in the former, fed in a finely ground form.

With the exception of some large cockerels the birds of Group 1 were of somewhat smaller stature than those of the other groups, notwithstanding the similarity in weight of Goups 1 and 2.

FEATHERING AND FEATHER PICKING.

Feather growth proceeded at more or less the same rate in all groups though the occurrence in Group 1 of feather picking at an early stage in the experiment made it appear as if the birds of this group were slower than those of the other groups in feathering. The individual birds picked and ate either their own feathers or those of their neighbours : this occurred more or less continuously in Group 1. Bare patches on the back, thighs, neck and breast and picked tails were frequent, and made this group appear very uneven and patchy. In contrast Groups 2 and 3 appeared satisfied and there was no appreciable picking. At the termination of the experiment the birds in Groups 2 and 3 were fully feathered, except in the case of a few chickens which showed bare areas of small size on the neck and back. The slight superiority of Group 3 over Group 2 in this respect may be accounted for by the more intimate mixture of the ground bran with the other ingredients of the mash so that the birds were unable to differentiate and were forced to consume a uniform mixture continuously.

Experiment B.

Maize (and Barley) Meal v. Wheat Bran v. Wheat Bran Fibre.

Three groups (forty-three chicks in each) were fed on the following mixtures

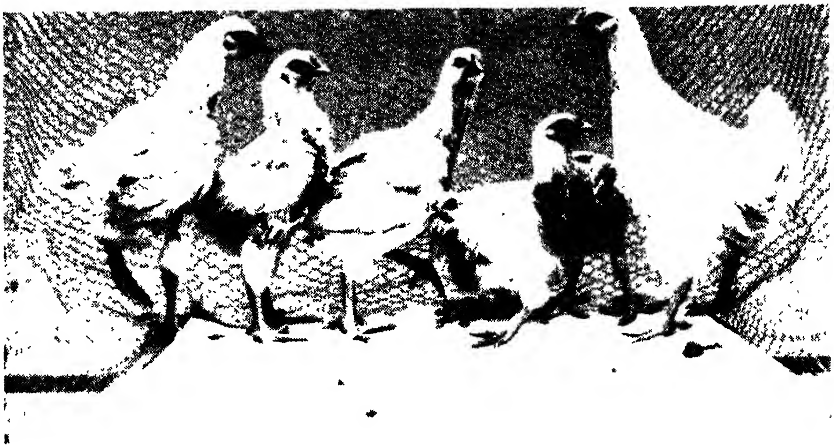
	Group 1	*Group* 2	*Group* 3
Cod liver oil ..	1	1	1
Ground limestone	1	1	1
Sterilised bone flour	1	1	1
Common salt ..	1	1	1
Meat meal ..	10	10	10
Finely-ground oats	15	15	15
Pollard	10	10	10
Maize meal ..	47	21	45
Barley	16	7	15
Bran	0	35	0
* Bran fibre ..	0	0	3
Fibre (per cent.)	3.7	6.4	6.4

* Bran fibre was prepared according to the technique used in conducting quantitative fibre determination, *i.e.*, by subjecting bran to the action first of weak acid and, after washing, of weak alkali, subsequently washing clear of all alkali, and then drying the final product.

An outbreak of coccidiosis, which occurred in the early part of the test, but which was subsequently checked, caused a set-back to the progress of these chickens and was responsible for casualties amounting to 17 per cent., 12 per cent., and 15 per cent. of the numbers in Groups 1, 2 and 3 respectively.

The final weights at the end of ten weeks' test were as follows :

		Average Weight lb.	oz.
Group 1	13 Cockerels ..	1	13
	28 Pullets ..	1	8
Group 2	14 Cockerels ..	2	5
	24 Pullets ..	1	14
Group 3	13 Cockerels ..	1	13
	24 Pullets ..	1	10



Exp. B Group 1

Exp. B. Group 2.

Exp. B. Group 3.

The following amounts of food were consumed :

	Group 1	*Group* 2	*Group* 3
	lb.	lb.	lb.
Per chicken during ten weeks ..	10½	12½	11

The water consumption was determined accurately during the 9th and 10th weeks of life, when the daily consumption per chick was as follows :

Group 1	*Group* 2	*Group* 3
oz.	oz.	oz.
3.8	7.7	4.1

The droppings of Group 2 were bulky and soft while those of Group 1 were comparatively dense and dry : those of Group 3 were intermediate in character.

It will be noted that Group 2 birds were appreciably heavier than those of Group 1, so that bran proved superior to maize, but the food consumption was also greater. The birds of Group 3 were similar to those of Group 1 in weight and in size : those of Group 2 were larger in body size. From the data of water and food consumption and the final weights it is evident that the effect of the bran fibre was unlike that of bran.

Feathering and Feather Picking.—The growth of feathers appeared similar in the three groups ; but from the third week of the test onwards the chicks of Group 1 showed a desire to pick at one another. This habit developed to a considerable extent and bare patches on the bodies of this group were obvious throughout the remainder of the test. At the termination some were naked and a number were only very sparsely covered. No trace of picking occurred in Group 2 till the sixth week when there was a very slight outbreak. Thereafter there was no further evidence of it and when the test terminated all the birds of this group were well feathered. Group 3 chickens in respect of feather-picking were intermediate between 1 and 2 : they were better feathered than those of Group 1 at the termination of the experiment, but inferior to Group 2 in this respect. As in Experiment A, bran proved superior to maize meal for the purpose of preventing feather-picking which, of course, is the prelude to cannibalism. Apparently the bran dietary produces a feeling of satiety which does not occur with the maize meal ration. Bran fibre, as prepared for this experiment, showed the effect to some extent, but conceivably the process of preparation altered its character considerably and destroyed some of its physical properties, rendering it in this respect rather like the fibre of oats. Photographs of some representative chickens, from each of the three groups, taken at the termination of the experiment, are shown.

Experiment C.

Maize Meal v. Flaked Maize v. Wheat Bran.

Three groups (fifty-five chicks in each) were fed as follows :

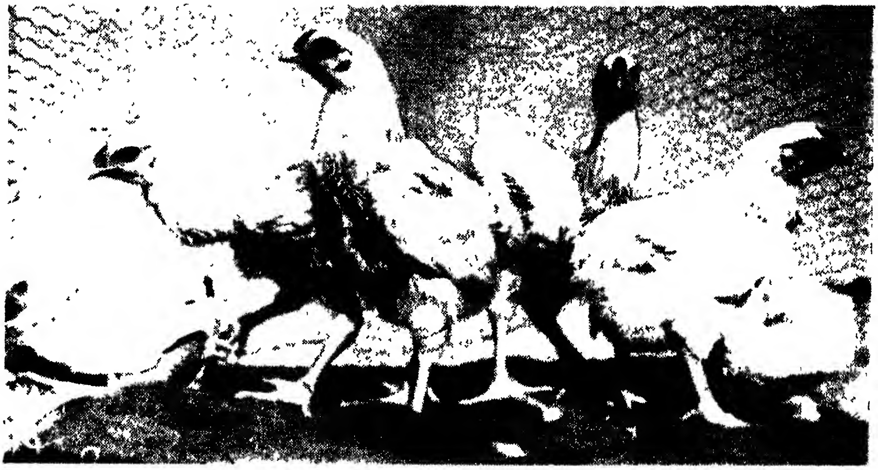
	Group 1	*Group* 2	*Group* 3
Cod liver oil ..	1	1	1
Ground limestone ..	1	1	1
Sterilized bone flour	½	½	½
Common Salt ..	½	½	½
Extd. soya bean meal	6	6	6
Fish meal	8	8	8
Finely ground oats ..	18	18	18
Pollard	25	25	25
Maize meal ..	40	0	0
Flaked maize ..	0	40	0
Wheat bran ..	0	0	40
Fibre (per cent.)	4.4	4.4	7.6

The final weights, after ten weeks on test, are stated below :

		Average Weight lb.	oz.
Group 1	20 Cockerels ..	2	8
	28 Pullets ..	2	4
Group 2	26 Cockerels ..	2	6
	20 Pullets ..	2	3
Group 3	22 Cockerels ..	2	4
	23 Pullets ..	1	12

Taking the weights of Groups 1 and 2 as being alike it is concluded that maize in the flake form has for chickens a nutritive value similar to that of maize in the form of meal.

Group 1 made an appreciably greater weight increment than Group 3, and the inference from this fact is that in Group 3 the optimum limit of fibre or " bulk " has been exceeded. In Experiment A, 35 per cent. of bran replaced maize, with advantage, in a ration otherwise comparatively low in fibre. Nor did the addition of 35 per cent. of bran prove disadvantageous in Experiment B, where the remainder of the ration contained little fibre.



Exp. C. Group 1.

Exp. C. Group 3.

In this experiment, *i.e.*, C, 40 per cent. of bran takes the place of maize in a dietary which among other items contains 18 per cent. ground oats and 25 per cent. of pollard. Apparently 40 per cent. of bran in addition to these foods was excessive.

A point to be noted in connection with the individual birds of the groups is that while those of Group 3 were a uniform lot in respect of size, there were in the other two groups some very small individuals as well as a majority of well-grown chickens. The pale pink colour of the legs and beak of the birds in Group 3 was in marked contrast with the yellow pigment of these parts in the other groups.

The bran-fed group produced large moist droppings as compared with the denser and drier droppings of Groups 1 and 2.

Feathering and Feather Picking. Feather growth proceeded at a similar rate in all groups, but feather picking appeared early in Groups 1 and 2 causing the birds to look patchy as compared with the completely covered birds of Group 3. Photographs of some birds from Groups 1 and 3, taken at the termination of the experiment, are shown.

EXPERIMENT D.

Wheat Bran (ground fine) v. Whole Oats (finely ground) v. Groats (dehulled Oats finely ground.)

Three groups each of fifty-five chicks were given the following food mixtures :

	Group 1	*Group* 2	*Group* 3
Cod liver oil	1	1	1
Ground limestone	1	1	1
Common salt	½	½	½
Milk powder	4	4	4
Meat meal	8	8	8
Pollard	26	26	26
Maize meal	25	25	25
Wheat bran (finely ground) ..	35	0	0
Whole oats (finely ground)	0	35	0
Groats or dehulled oats (finely ground)	0	0	35
Fibre (per cent.) ..	5.6	5.6	3.2

Mortality was quite low, and after ten weeks on test the weights were as follows :

			Average Weight lb.	oz.
Group 1	24 Cockerels	..	2	10
	28 Pullets	..	2	5
Group 2	25 Cockerels	..	2	10
	25 Pullets	..	2	5
Group 3	26 Cockerels	..	2	7
	25 Pullets	..	2	1

The following amounts of food were consumed per chicken during ten weeks :

Group 1	*Group* 2	*Group* 3
lb.	lb.	lb.
10½	10½	9

Water consumption per chick per day in the fourth and fifth week of life was as follows :

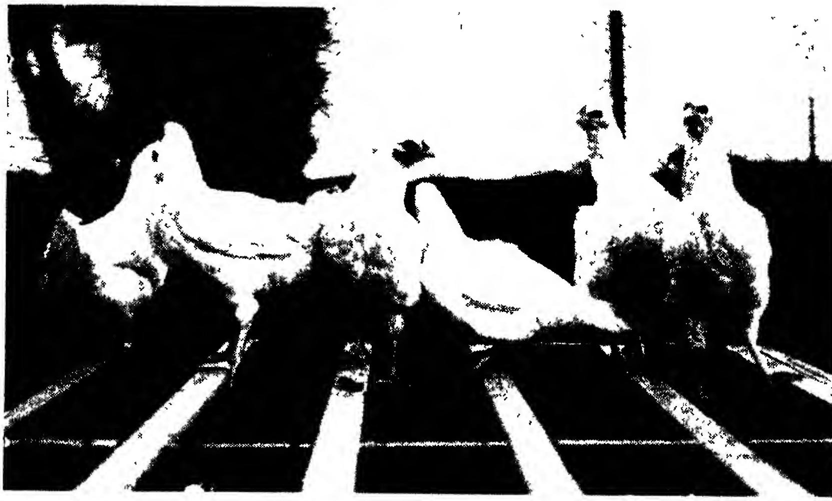
Group 1	*Group* 2	*Group* 3
oz.	oz.	oz.
2.2	1.8	1.4

The droppings were very much more bulky and softer in the case of Group 1 than in 2 and 3, the latter two groups being alike in this respect.

From the point of view of increase in weight it would appear that under the conditions of this experiment the fibre of oats had practically the same if not the same value in a mixed ration as that of bran, the percentage of fibre in both bran and oats being approximately similar, namely 10. Later tests showed, however, that under other conditions bran is superior to oats.

Groats did not prove such a useful food for chickens as whole oats ground, but this is partly accounted for by the lower food consumption of the groats-fed group.

Feathering and Feather Picking.—The growth of feathers was slower in Groups 2 and 3 than in 1 in which the adult covering replaced the baby down more completely at an early age. The birds of Group 1 appeared completely satisfied with their dietary while those of the other two Groups showed a great desire to chase any extraneous material which found its way into their compartment. This desire further manifested itself in the



Exp. D. Group 1.

Exp. D. Group 2.

habit of picking and eating one another's feathers. Once developed, this habit persisted and at the end of the Test there was a great contrast in feather covering. Group 1 was completely clothed while Group 2, and more decidedly Group 3, were patchy, many of the birds showing bare patches on the back, breast, thighs and wings. In some cases chicks picked at their own feathers, but more frequently attention was paid to their neighbours, and on many occasions birds whose own feathering was complete, or almost so, were observed viciously devouring the feathers picked from other chickens. Photographs of some birds from Group 1, 2 and 3 of this experiment are shown.

Experiment E.

Bran v. Finely Ground Oats v. Oats and Barley v. Oats, Barley and Maize.

One hundred and sixty chickens were divided equally into four groups and fed mixtures made up according to the following formulae.

	Group 1	Group 2	Group 3	Group 4
Cod Liver Oil	1	1	1	1
Salt	1	1	1	1
Ground Limestone ..	1	1	1	1
Meat Meal	13	13	13	13
Barley Meal	20	20	0	0
Maize Meal	40	40	40	20
Finely Ground Oats ..	25	5	5	5
Wheat Bran	0	20	40	60
Fibre (per cent.) ..	4.3	4.3	5.3	6.9

Mortality, due principally to accident, was high, and at the end of 10 weeks test the numbers remaining in the groups, and the average weights were as follows :

		Average Weights lb.	ozs.
Group 1	16 Cockerels	2	8
	14 Pullets	1	15
Group 2	14 Cockerels	2	13½
	18 Pullets	2	3½
Group 3	9 Cockerels	2	15
	20 Pullets	2	3¾
Group 4	10 Cockerels	2	3
	19 Pullets	1	15

The amount of food consumed is given in the following table :—

	Group 1	Group 2	Group 3	Group 4
Per chick during the 10 weeks of test ..	10½ lb.	10½ lb.	11½ lb.	12½ lb.

Though Group 2 ate the same amount of food as Group 1 the final weights of the chickens were appreciably greater, indicating that under the conditions of this experiment the replacement of finely ground oats by wheat bran enhances the nutritive value of the ration. The absence of milk powder and pollard from the control (Group 1) will be noted. On the assumption that the final weights of Groups 2 and 3 are similar, the conclusion is come to that, from the weight increment point of view, a ration containing 40 per cent. of bran is as good as one containing 20 per cent. It will be noted however that the food consumption by Group 3 was greater than that by Group 2. The weights of Group 4 chickens are definitely below those of Groups 2 and 3 so that it would appear that in this case the food mixture contains excessive amounts of fibre and " bulk." Notwithstanding the greater food consumption by Group 4 the chickens were unable to ingest sufficient nutriment to provide for an increase in weight comparable with that obtained in the case of Groups 2 and 3. This was particularly noticeable in the first week of the experiment when, though the chicks were continuously eating, they never appeared satisfied and were obviously weakening. Actually this Group was placed on Group 2 food mixture for the first four days of the second week till their strength was sufficiently built up to restore their own 60 per cent. bran dietary. At the termination of the experiment the birds in Group 4 were thinner than those of the other groups while Group 1 birds were the fattest. Group 4 appeared larger than the others, but whether they had bigger carcases was difficult to determine. Possibly the average size of the individuals in Groups 3 and 4 was somewhat greater than that of Group 1, Group 2 being intermediate.

There was a noticeable progressive change in the character of the droppings from Group 1 to Group 4. They got more bulky and softer in texture as the proportion of bran in the dietary increased. The floor of compartment No. 3 remained moist throughout the period of the experiment, while that of No. 4 (60 per cent. bran group) was decidedly wet.

Feathering and Feather Plucking.—The feather growth of Groups 2, 3 and 4 was similar and proceeded at a satisfactory rate ; that of Group 1 was slower. Feather picking began in Group 1 in the second week of the experiment and continued throughout, the birds of this Group showing extensive nude areas when the experiment terminated. Group 2 became restive in the third week and picked a little ; this continued in the fourth and fifth weeks, but became less evident later. In Group 3 a few individuals picked in the sixth and seventh weeks but on the whole there was very little evidence of feather

picking as judged by the existence of uncovered patches of skin at the termination of the test. At no period was there any evidence whatsoever of feather picking in Group 4.

Experiment F.

Wheat Bran and Pollard v. Finely Ground Oats and Molassed Beet Pulp.

Two groups of chickens were given the following mixtures :—

	Group 1	Group 2
Cod Liver Oil	1	1
Common Salt	1	1
Ground Limestone.. ..	1	1
Meat Meal	14	14
Maize Meal	28	28
Bran	40	0
Pollard	15	0
Finely Ground Oats ..	0	40
Molassed Beet Pulp ..	0	15
Fibre (per cent.) ..	5.5	6.8

Group 1 made normal progress, but Group 2 very quickly developed an unthrifty appearance. The increase in size and weight of Group 2 was considerably below that of Group 1, but the remarkable feature of Group 2 was the stagnation of feather growth. Chicken down persisted in the majority of the birds and it appeared ruffled and unpreened giving the chickens a most dejected appearance. Another remarkable feature of this group was the development of " crow head." which obviously was connected with the feeding, as the brothers and sisters in Group 1 developed normal heads. The poor condition of Group 2 brought the experiment to a termination after six weeks of test.

The abnormal effect of the meal mixture fed to Group 2 was not the result of a high quantity of fibre *per se* because a higher fibre consumption—in the 60 per cent. bran ration for instance—in other tests gave no such extraordinary results. Either the specific effect on the food tube of the oats-beet pulp mixture or a deficiency in the dietary given Group 2 was responsible, and the phenomenon requires further investigation.

Experiment G.

Bran (fed dry) v. Bran (soaked) v. Ground Oat Hulls (soaked).

Three Groups of 35 chicks each were fed as follows :—

	Group 1	Group 2	Group 3
Cod Liver Oil	1½	1½	1½
Common Salt ..	½	½	½
Ground Limestone ..	½	½	½
Sterilised Bone Flour ..	½	½	½
Meat Meal	12	12	12
Pollard	10	10	10
Barley	16	16	16
Finely Ground Oats ..	11	11	11
Maize Meal	23	23	40½
Bran (Wheat)	25	25	0
Finely Ground Oat Hulls	0	0	7½
Percentage of Fibre	5.38	5.38	5.33

Group 1 was given the mash in the dry condition, but for Groups 2 and 3 the mixture was soaked in water before feeding.

Food consumption was not recorded in this particular test. The weights reached at the end of the ten-week feeding period are given below.

		Average Weight lb.	ozs.
Group 1	12 Cockerels	2	8
	18 Pullets	2	4
Group 2	14 Cockerels	2	11
	17 Pullets	2	3
Group 3	10 Cockerels	2	0
	17 Pullets	1	10

Taking the weights of Group 1 and 2 as being more or less alike, it would appear, though the result of this experiment does not warrant any definite conclusion, that the feeding of the mash in the moist condition gives no better results than when it is fed in the dry form. The weights of Group 3 are, however, definitely less than those of Group 2, showing a difference in result from two mashes which contain the same percentage of fibre but in one of which approximately half the fibre was supplied by bran and in the other approximately half was supplied in the form of oat hulls.

Feathering and Feather Picking.—Normal feather growth appeared in Groups 1 and 2, where however, some feather picking made its appearance. The outbreaks were not very serious however, but nevertheless their occurrence showed that 25 per cent. of bran, when fed either dry or wet, was not sufficient under the conditions of this experiment completely to prevent it. Feathering proceeded less rapidly in Group 3 where, in some individuals especially, the chick down persisted for an abnormally long period. The picking of feathers made its appearance in the fifth week and became serious in the succeeding weeks and right to the end of the experiment when only 15 per cent. of the birds were completely feathered as compared with 65 per cent. in Groups 2 and 3.

Experiment H.

The Addition of Wheat Bran to a Dietary made complete with Liver Meal and Milk Powder.

Two Groups of 36 chicks each were fed as follows :—

	Group 1	Group 2
Cod Liver Oil	1	1
Ground Limestone	1	1
Sterilised Bone Flour	½	½
Salt	½	½
Dried Milk	5	5
Liver Meal	10	10
Maize Meal	62	42
Barley Meal	20	15
Wheat Bran	–	25
Fibre (per cent.)	2.1	4.0

The food consumption during a period of nine weeks was 9½ pounds per chicken in both Groups. and the weights. after the intervals indicated. were :

	Group 1 lb. ozs.	Group 2 lb. ozs.
At the end ot 4 weeks	12.6	13.8
,, ,, 6 ,, ...	1 3.2	1 5
,, ,, 9 ,, ...	2 1.2	2 4.9

While there was not an appreciable difference in the weight increments yet the superiority of Group 2 over 1 in this respect at all stages in growth is noteworthy.

Feather Picking.—Feather picking appeared in Group 1 in the fifth week of the test and it continued till the conclusion. There was no indication of picking in Group 2. The state of feathering at the termination of the test is indicated below :—

Group 1.	10 chickens completely feathered.
	8 chickens bare on chest only.
	2 chickens bare on chest and back.
	4 chickens bare on chest, back, wings and tail.
	10 chickens almost naked.
Group 2.	34 chickens completely feathered.

Photographs of some chickens from both Groups are reproduced.

Obviously the addition of bran to a chemically complete concentrated mixture altered its effect on the behaviour of the birds.

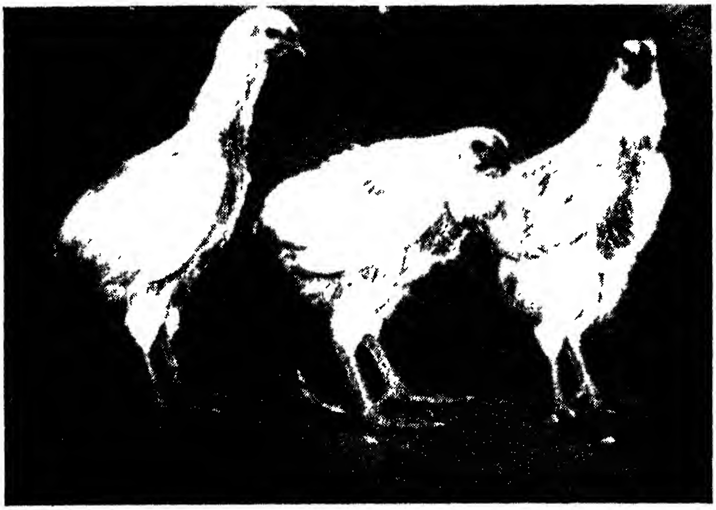
Experiment I.

Bran v. Oats in a complete Dietary.

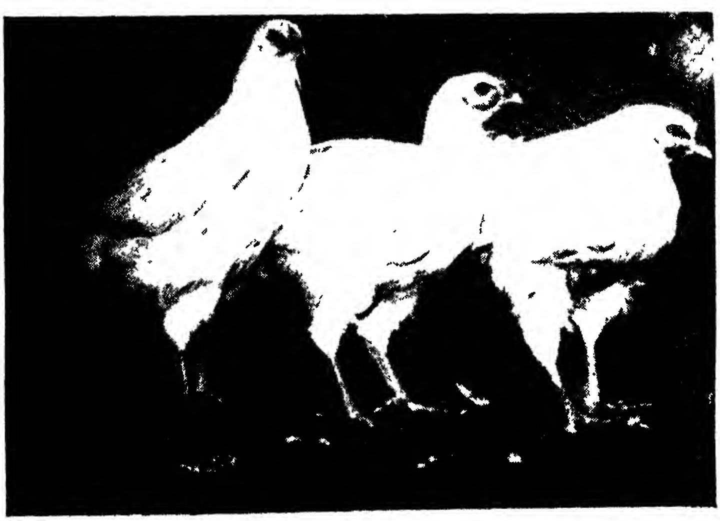
Two Groups of 38 chicks each were given the following food mixtures :—

	Group 1	Group 2
Cod Liver Oil	1	1
Sterilised Bone Flour	$\frac{1}{2}$	$\frac{1}{2}$
Ground Limestone	1	1
Salt	$\frac{1}{2}$	$\frac{1}{2}$
Milk Powder	5	5
Liver Meal	10	10
Barley	12	12
Maize	40	40
Wheat Bran	30	—
Oats—Finely Ground	—	30
Fibre (per cent.)	4.3	4.3

The food consumption per chick in eleven weeks was in Group 1, 12$\frac{3}{4}$ lb. and in Group 2, 12$\frac{1}{4}$ lb.



Exp. H. Group 1.



Exp. H. Group 2.

Exp. J. Group 3.

The weights at the termination of the test were :-

Group 1.	Pullets (average)	.. ..	2 lb. 13 ozs.
	Cockerels (average)	.. ..	3 lb. 6 ozs.
Group 2.	Pullets (average)	.. ..	2 lb. 11 ozs.
	Cockerels (average)	.. ..	3 lb. 3 ozs.

The food consumption and the weight increments of the birds in Group 1 were very slightly greater than those of Group 2. The difference was small however, and was such as to indicate that with similar food consumption the gains made by both Groups would be alike.

Feathering and Feather Picking.—Both Groups, in which the plumage grew at a similar rate, showed a tendency to pick at the feathers for the first time in the fourth week of the experiment. The habit persisted in a mild fashion in Group 1 for a few weeks, after which it became successively less evident, and then disappeared. In Group 2 however, it became more pronounced and while at the termination of the test none of Group 2 chickens was completely feathered and many were semi-nude, practically all the chickens in Group 1 were completely covered with a good coating of feathers.

Experiment J.

Oat Hulls replacing Maize Meal.

This experiment was conducted chiefly for the purpose of making observation on feathering and feather picking, and figures for weight increment are not presented. There were three Groups, fed as follows :-

	Group 1	Group 2	Group 3
Cod Liver Oil	1	1	1
Common Salt	1	1	1
Ground Limestone	½	½	½
Sterilised Bone Flour	½	½	½
Meat Meal	12	12	12
Finely Ground Oats	11	11	11
Pollard	10	10	10
Barley	16	16	16
Maize Meal	48	38	28
Oat Hulls—Ground ..	0	10	20
Fibre content (per cent.)	3.4	6.0	7.6

Feather growth was more rapid in Group 1 than in Groups 2 or 3, in both of which the babychick down persisted rather long. By the fourth week all three groups were picking severely and, while this continued to the end in the case of Group 1, it lessened considerably in severity in Groups 2 and 3 from which it disappeared after the ninth week of the test.

Even 7.6 per cent. of fibre in Group 3 failed to prevent feather picking entirely; indeed, 7.6 per cent. was no better than 6.0 per cent. Yet in many of the earlier experiments groups which were fed on mixtures containing 30 to 35 per cent. of bran containing only from 5¾ to 6 per cent. of fibre showed little or no desire to feather pick. These results indicate a considerable difference in the quality of bran and oat fibre as judged by the behaviour of the chickens. A photograph of some chickens from Group 3 is reproduced.

Experiment K.

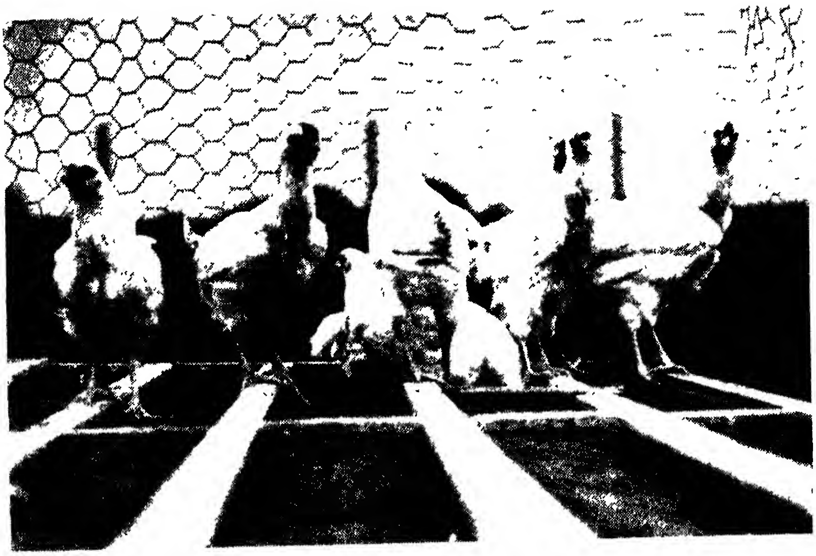
Molassed Beet Pulp replacing Maize and Barley.

As in Experiment J this test was conducted chiefly for the purpose of observing feather growth and the incidence of feather picking. The following mixtures were fed to 3 groups :—

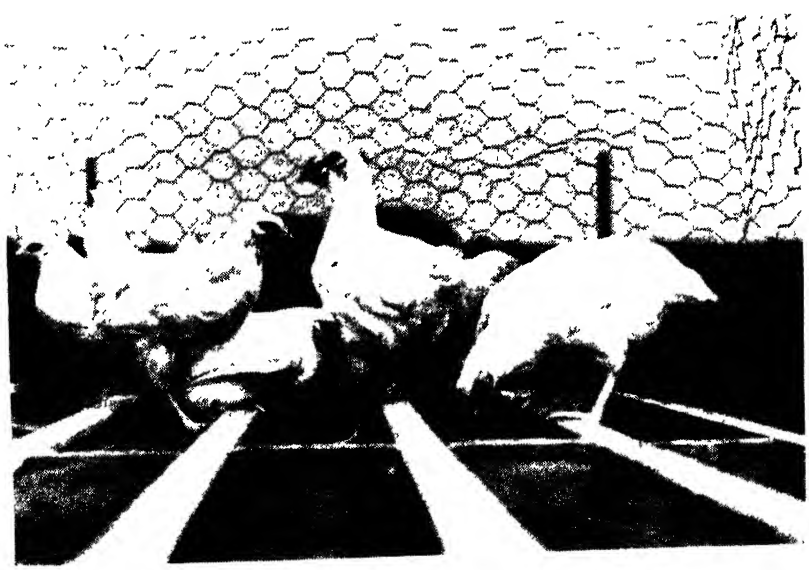
	Group 1	Group 2	Group 3
Cod Liver Oil	1	1	1
Salt	1	1	1
Ground Limestone	½	½	½
Sterilised Bone Flour	½	½	½
Meat Meal	13	13	13
Finely Ground Oats	25	25	25
Barley Meal . ..	20	20	0
Maize Meal	40	20	20
Molassed Beet Pulp	0	20	40
Fibre (per cent.)	4.3	6.9	8.9

Feather growth was more or less alike in all groups. The picking of feathers began in the third week in Group 1 and continued throughout the period of the test. Feather picking occurred to a less degree in Group 2 and less still in Group 3. Photographs of some chicks from Groups 1 and 3 are reproduced.

Judged by the appearance and the handling of the birds molassed beet pulp is not a suitable ingredient of a chicken mash. The individuals of



Exp. K. Group 1.



Exp. K. Group 3.

Group 2 were less well developed and obviously lighter than those of Group 1, while those of Group 3, though looking average on the floor, were poorly conditioned and badly developed. Indeed, the mixture supplied to Group 3 was necessarily withdrawn for some days in the second week of the test so as to prevent the occurrence of excessive casualties from the high proportion of molassed beet pulp. It was gradually replaced later.

Notwithstanding the unsuitability of molassed beet pulp as a food the incidence of feather picking was lessened by the inclusion of a considerable proportion of it in the dietary of chickens.

Supplementary Tests.

For Observations on Feather Picking

A group fed on the mash provided to Group 1 of Experiment K was compared with other groups fed a similar mash into which steeped molassed beet pulp and finely chopped mangels respectively, were incorporated in proportions which were varied as desired. Observations showed that feather picking could be controlled partly, if not entirely, by increasing the proportion of beet pulp or of mangel in the mixture. The percentage of either of these two foods which checked the vice was, however, obviously too great for maximum or indeed for normal growth.

Further Tests were conducted in which linseed meal, agar, and pectin were fed as part of the ration. There appeared no evidence to show that the inclusion of small amounts of linseed meal or agar helped in the prevention of feather picking. When the proportions were increased to such a level as might have a favourable influence, the rations proved decidedly unsuitable for the birds. A low concentration of pectin in water, such as is prepared for addition to certain jams to produce a gel effect, was fed instead of water in another test and the results indicated the existence in it of a property which checks, at least partially, the tendency on the part of chicks to seek extraneous matter and feather pick.

(V). DISCUSSION.

Bulk, in relation to food, refers to the volume of or the space occupied by a unit weight. It is related to the amount of fibre in the food, to the water content, and to the physical make-up of the material. Oats are more bulky than barley because of their greater fibre content, mangel in virtue of its high water content has more bulk than dried beet pulp, and a loaf of bread, because of its leavened puffed physical condition, is more bulky than the weight of flour from which it is made. As regards intake of food it is obvious

that the level of the fibre or of the water in any food or mixture of foods may be so high as to prevent the ingestion of sufficient digestible material so that in respect of either of these factors an excess of " bulk " may be easily reached. Conversely, the possibility of enhancing the value of a very concentrated food mixture by including more fibre or more water and thus increasing the bulk also arises. By water in this connection is understood not added fluid but rather the water which forms part of the constitution of the food as in the case of roots or potatoes.

The physical make-up of foods as a point apart from the contents is important in the feeding of certain farm animals, but the results of Experiment C in which maize meal and flaked maize were compared, would appear to show that an alteration in the character of the food, without any appreciable change in the chemical content, does not affect its nutritive value for the fowl. There is a related result from Experiment A, which showed that bran in the flaked form was no different in its nutritive effect to bran ground into a flour or meal.

It may be argued that a possible beneficial effect arising from an alteration in the physical character of the predominant ingredient of a ration may not be expressed if the food mixture already contains sufficient fibre or water to render it rather bulky, but in Experiment C, where dry mash was fed, and where the percentage of fibre in the dietary of Groups 1 and 2 did not exceed 4.4 per cent., it is claimed that the conditions for the expression of any such effect were present. Hence it would appear that in the dietary of chickens bulkiness in so far as it is affected by the physical make-up of the foods is a factor of little consequence. This is in conflict with results from pig experiments in which it has been shown that the flake form is more palatable in the early life of the pig (20).

The effect of fibre on the other hand is pronounced. In Experiment A, Group 2, consuming a ration containing 5.6 per cent. of fibre, made the same progress as Group 1, eating a ration containing 2.7 per cent. of fibre, both taking more or less the same quantity of food. Again in Experiment B, Group 3 on a 6.4 per cent. fibre ration made the same gains as Group 1 on a mixture containing 3.7 per cent. fibre, the consumption in both being approximately the same. Group 2 of this experiment which ate a mixture of the same fibre content as Group 3 made greater gains than Group 1. Again, in Experiment E, Group 3, on a mixture having 5.3 per cent. of fibre, proved equal to Group 2, on a 4.3 per cent. fibre mixture. Where, as in the case of the last two comparisons, appreciably greater gains were made more food was consumed, and it is conceivable that this was responsible for the definite superiority in these cases. However, there is sufficient evidence from Experiment A and B, where like quantities of food were consumed, to show that a reduction in the concentration of a concentrated dietary by the addition of fibre does not limit the progress of the chickens. Obviously an increase

in fibre content reduces the energy value and if, with similar consumption, a food mixture of less energy value proves as nutritive to the chicken as one of higher energy value then the rendering of the dietary more bulky by the greater fibre content must have a beneficial effect sufficient to counteract the reduced energy intake. It would appear therefore, that a dietary improves as its fibre content increases up to a point.

Experiment H. was conducted to get finality on the point and the results from it make it clear that the rendering of a concentrated, though chemically complete, dietary more bulky by the addition of a fibrous food enhances its value. It will be noted that the addition of bran in this case raised the percentage of fibre in the ration from 2.1 to 4.0.

That there is an optimum figure and that excess of fibre is possible is shown by the results of Experiments C and E. Group 3 of Experiment C eating a mixture containing 7.6 per cent. of fibre made less progress than Group 2 whose dietary contains 4.4 per cent. of fibre, and again, the gains made by Group 4 of Experiment E were less than those made by Group 3, the percentage of fibre in the food mixtures being 6.9 and 5.3, respectively.

It would appear from the evidence presented in the last two paragraphs that the optimum proportion of fibre did not lie at a narrowly defined point, but rather extended over a range falling perhaps below 5 and rising to 6. The percentage of fibre in Lippincott's poultry feeding mixtures approximates to 5 (21) a figure which Halnan suggests should not be exceeded (22). Halnan (23) in a later communication, however, asserts that "the inclusion of bran in chick feeding mixtures would appear to be justified on dietetic grounds in spite of its relatively poor value measured by digestibility trials." In the various experiments in connection with this investigation it was observed that concentrated mixtures produced fatter birds than did bulky mixtures so that chickens intended for the table at 12 or 13 weeks may be given a dietary approximating to or not far exceeding 5 per cent. of fibre while others in which growth and good constitution are specially desired may have the fibre in their dietary approximating to 6 per cent. In a mixed group of pullets and cockerels the latter may go on to a more concentrated mixture after the sexes are separated.

The keen poultry man who wants vigorous growth and good production subsequent to the chick stage likes to feed his chickens on a rather bulky mash, and in this connection the enlargement of the small intestine as a result of increasing the proportion of alfalfa meal in the ration from 5 per cent. to 20 per cent. as noted by Sampson and Mussehl (24) is suggestive.

Notwithstanding these generalisations it is necessary, in the making up of a chicken ration, to have regard to something more than the mere percentage of fibre *per se*. In Experiment B, for instance, the chickens in Group

2 made appreciably better gains than those of Group 3 though both lots ate mixtures of approximately the same fibre content. It will be noted that Group 2 consumed more food than 3 but for this fact there must be an explanation. In Groups 1 and 2 of Experiment E, the fibre content of the mixtures and also the food consumption were alike ; yet the bran group was definitely superior to the comparable oat group. Again, in Experiment G, the bran group proved superior to the oat hull group though both were alike in respect of food consumption, and in the fibre content of the dietary. Yet in Experiment D two groups, namely 1 and 2, which were alike both in food consumption and in the fibre content of the mixtures, and in which oats and bran were directly compared, made similar progress. Again, in Experiment I, which was conducted to compare oats with bran in a thoroughly complete mixture, both groups on a similar food consumption made similar gains. Why this apparent inconsistency in the results ? Presumably bran contains some virtue which oats do not possess, and which is expressed in certain circumstances and not in others. Another piece of investigation in progress in this Department is demonstrating the fact that a dietary containing the following materials, namely oats, barley, maize, meat meal, salt, limestone, sterilised bone flour, cod liver oil, alfalfa stem meal, and extracted soya bean meal (at least certain samples), is deficient in some factor or factors necessary for vigorous health and maximum progress. Milk, milk powder, milk whey, liver meal, brewers' dried yeast, and succulent young herbage are very potent in the factor or factors concerned while wheat bran and, to a lesser extent pollard, are fairly rich sources thereof. Now when the dietaries used in Experiments B, D, E, G, and I are examined it is shown that in those cases where oats and wheat bran proved equal—Experiments D and I—the remainder of the dietary contained 8 per cent. of milk powder and 26 per cent. of pollard in one case and 5 per cent. of milk powder and 10 per cent. liver meal in the other case, that is to say, the dietary, even in the absence of oats or wheat bran, was chemically complete. On the other hand, in Experiment E, the food mixture to which the oats and bran were respectively added, that is, the basic portion of the ration, must have been incomplete, none of the rich or fairly rich sources of the factors discussed above being included ; and again, in the Experiments B and G there must have been a similar deficiency in the basic part of the ration which included none of the potent sources of these limiting factors and contained a mere 10 per cent. of pollard. Bran contains certain food factors in which oats are deficient, and the expression of the equality or superiority of bran in comparison with oats depends on the presence or absence of these food factors in the remainder of the dietary in which the oats and bran are compared.

The extraordinary history of Group 2 of Experiment F is worthy of special mention. Extremely poor progress was made and yet the percentage of fibre (derived mainly from oats and sugar pulp) in the dietary stood at a figure, namely 6.8 per cent., which was below that ot certain Groups in other

experiments in which almost normal progress was made. Presumably the dietary was seriously deficient or else it contained some toxic principles. The conclusion of Halnan (25) that molassed pulp is not a suitable food for poultry is interesting in view of the foregoing results. The slow rate of feathering in this Group is the subject of another reference later.

In the Experiments described the chickens were reared in confined quarters of relatively small area without litter. These are the conditions which incite cannibalism and the opportunity was availed of to study the relationship between the physical character of the ration and the behaviour of the birds as regards cannibalistic tendencies. The picking of feathers either from the bird's own body or from the body of its neighbours is a forerunner of cannibalism. In certain of the experiments it was necessary to check, by the use of a smear, cannibalism following vicious feather picking ; in others, feather picking of a mild nature occurred : in certain others the vice did not appear at all.

Severe picking developed in Group 1 of Experiment A, Group 1 of Experiment B, in Groups 1 and 2 of Experiment C, and in Group 1 of Experiment H, all of which ate a concentrated dietary. In marked contrast was the behaviour of the birds of Groups 2 and 3 of Experiment A, Group 2 of Experiment B, Group 2 of Experiment H, and more especially the behaviour of Group 3 of Experiment C which consumed a dietary containing 40 per cent. of wheat bran and in which not the slightest suggestion of feather picking manifested itself. The high fibre content of those groups in which feather picking did not appear or only appeared in a minor degree does not in itself furnish an explanation of the inhibition of feather picking. In Experiment D, for instance, Group 1, whose fibre was mainly derived from bran, did not feather pick at all, whereas Group 2 did pick, though not severely. Apparently bran had a satiating effect on the birds, a property which oats only partly possess. Experiment E showed in a convincing way that the tendency on the part of chickens to look for extraneous material and to pick at the feathers of other chickens became less as the percentage of bran in the dietary was increased. That the soaking, before feeding, of wheat bran or oats did not alter their comparable effect on the behaviour of chicks was shown by the results of Experiment G.

The addition of oat fibre, or oats, to a concentrated ration does, to a degree, check the desire to feather pick. This was shown by Experiment J. The remarkable point, however, was that the further addition of oat hulls to raise the fibre content, which in Group 2 was 6 per cent., to 7.5 per cent. in Group 3 did not improve the ration in this respect. Yet mixtures whose fibre content by the use of bran, was raised to the proximity of 6 per cent. were effective in preventing even a suggestion of feather picking. Still further evidence of the difference between oats and wheat bran in this respect is forthcoming from Experiment

I where a mixture which lacked no nutritive factor was fed. In that experiment the bran group picked only very slightly and for a short period while considerable feather picking took place in the oat group. In this as in other experiments, however, the birds receiving oats in their dietary were less inclined to vicious picking and cannibalism than birds on a concentrated dietary.

Oats, oat hull and treated bran fibre all inhibited, to an extent, feather picking. That this is connected with the extra fibre added to the dietary when these foods are used is borne out by some results from Oklahoma Station (26) in which there was less feather picking in pens fed the higher levels of fibre.

Molassed beet pulp also prevented feather picking- Experiment K- -but the proportion of pulp required for this purpose is too high to allow for normal growth of the birds. Further evidence of the utility of molassed beet pulp and also of mangels in the prevention of feather picking is forthcoming from the supplementary tests, but again the results show that, to be effective, quantities far too excessive to allow for normal growth would necessarily have to be used. There was also a favourable affect on the birds' behaviour from the use of pectin. For the purposes of another investigation in progress fresh, short lawn clippings were fed *ad lib.* in addition to a concentrated dietary. Data collected show that when consumed in considerable quantity lawn clippings inhibit feather picking.

It is a matter of common observation that the character of the droppings of chickens depends on the dietary. Birds on a concentrated food mixture void dense dry droppings, those which are eating a fair proportion of oats yield more bulky though dry droppings, while in the case of birds on a bran dietary the droppings are very bulky and moist. Actually it is difficult to maintain a clean dry floor under birds whose dietary includes much bran. Washed bran from which the phytin has been abstracted has the same laxative effect as untreated bran, according to Cowgill and Anderson (27) who in human nutrition point to a definite relationship between the rate of laxation and the amount of fibre ingested daily. A large percentage of pollard has an effect similar to that of a small proportion of bran. The effect of bran in considerably increasing the water consumption of birds was pronounced in this investigation. Sugar pulp, mangels and pectin, like bran but unlike oats, cause the voiding of moist bulky droppings. Soft, bulky faeces indicate the presence in the lower gut of much liquid which has not been absorbed. Roots, green herbage, bran and, to a much lesser extent, pollard hold the water as they pass along the food tube so that the residue after absorption of the digested nutrients is comparatively, very moist. This type of unabsorbed residue produces a distended condition of the lower gut. All fibrous foods increase the volume of the droppings but, while the undigested residue of such materials as oats merely enlarges them by the extent of the extra fibre, the residue

of other foods such as bran, in virtue of its greater water content, has far greater volume and " bulk."

In an earlier communication (1) in which, *inter alia,* the functional activity of the rectum is discussed it is contended that optimum health in the body depends, among other things, on a healthy condition in the alimentary tube. The maintenance of such a condition in the lower gut is promoted by moist bulky fæces which, by dilating the tube, stimulates *peristalsis* and causes the regular and complete evacuation of all fæcal residue, thus preventing the absorption of toxic products of decomposition in the lower gut. The experiments described in this paper bear out these hypotheses and show the necessity from this point of view of keeping in mind the mechanical aspect of nutrition in the preparation of a suitable ration for chickens. There is good evidence of a relationship between the bulkiness of the dietary and the utilisation thereof by chickens and also of a connection between the functional activity of the lower gut and the behaviour of chickens as far as feather picking and cannibalism are concerned.

A correct mechanical condition of the dietary is not in itself a safeguard against picking; in addition all the chemical nutritive ingredients must, of course, be present.

In the practical application of the subject the necessity for attention to this aspect of feeding does not always arise, as for instance, when birds are reared on grass runs or where soft greenish meadow hay is used as bedding. Chicks which have access to pasture eat just enough of it to regulate the physical condition of the entire daily food consumption to the degree required by the body. If the dietary is very concentrated much grass is consumed, if very bulky there is little consumption of grass. To a less degree the eating of the bedding or litter contributes towards the regulation of the physical character of the total food intake. When, however, chickens are reared on bare floor or wire netting their complete dependence on the dietary supplied them throws on the feeder the responsibility for so selecting and adjusting the ingredients of the mixture as to render the ration satisfactory not alone from the chemical but also from the mechanical aspect.

The growth of feathers must not be confused with feather picking. Feather growth was satisfactory in the case of most of the experiments. In a few instances, however, the chicken down persisted abnormally long, namely Group 2 of Experiment F, Group 3 of Experiment G and Groups 2 and 3 of Experiment J. In all these cases the proportion of oats or of oat hulls fed was very high. The stagnation of feather growth was most pronounced in Group 2 of Experiment F, but in that casee sugar pulp in addition to a high proportion of oats was included in the dietary. Persistence of baby down and very slow growth of feathers was also observed in another experiment, containing 40 per cent. ground oats which was con-

ducted for another purpose. There is not sufficient evidence from this work however, to warrant any definite statements with regard to the relationship between the feeding and the growth of feathers nor was this investigation intended to study that problem.

SUMMARY.

The experiments reported in this paper were conducted on chickens reared on an all-mash dietary from hatching, indoors and, after the fourth week of life, without litter.

The following is a summary of the results obtained, the discussion thereon, and the conclusions arrived at.

1. "Bulk" in a dietary is related to the fibre and water content and to the physical condition of the foods which constitute the dietary.

2. In poultry feeding an alteration in the physical condition of a food, rendering it more or less bulky, without affecting the chemical composition, does not change the nutritive value; flaked maize is equal to maize meal, and bran in the ground form is equal to the flaked product ordinarily fed.

3. Up to a point an increase in the fibre content of a chicken mash is beneficial; excess of fibre acts definitely as a limiting factor to progress; the optimum percentage of fibre does not lie at a narrowly defined point but rather ranges from somewhat below 5 up to about 6 per cent.; the lower figure is best for rapid fattening and the higher for good growth and satisfactory progress subsequent to the chicken stage.

4. Food mixtures of similar fibre content may differ in nutritive value because of unsuspected deficiency in certain food factors; under one set of conditions, *i.e.*, in a mixture from which none of the known nutritive ingredients is absent, wheat bran is equal to oats containing the same amount of fibre, while under other conditions wheat bran is definitely superior; bran contains a nutritive factor or factors (present to a lesser extent in pollard and abundantly supplied by milk, whey, liver meal, brewers' yeast, and young, green herbage) which are absent from oats.

5. Feather picking, which is a forerunner of cannibalism, occurs when

the dietary is concentrated whether it is chemically complete or otherwise; the addition of fibre to the dietary by the inclusion of oat hulls or the fibre extracted from bran prevents feather picking to a degree; the addition of fibre by the inclusion of wheat bran in the mixture is effective in completely preventing feather picking; the incidence of feather picking decreases as the proportion of wheat bran in the food mixture is raised; on the other hand, no amount of the fibrous material of oats completely prevents this vicious practice: wheat bran is thus superior to oats a food of similar fibre content for the purpose of preventing feather picking: when a food mixture which otherwise contains very little fibre includes one-third of its weight of wheat bran the incidence of feather picking, even under conditions of confinement is, if the dietary is chemically complete, reduced to low dimensions: 40 per cent. of wheat bran almost eliminates feather picking; a very large proportion of pollard has, in this respect, the same effect as a small proportion of bran.

6. Lawn clippings, fed *ad libitum*, and mangels and molassed beet pulp in very considerable quantity inhibit feather picking: the proportion of mangels and of molassed beet pulp which is effective in this respect is, however, much in excess of that which enables normal growth to take place; there is evidence of the utility of pectin in the prevention of feather picking.

7. Fibrous foods which only partly prevent feather picking produce slightly enlarged but dry droppings; fibrous and other foods which completely prevent feather picking produce very bulky moist droppings: bulky moist droppings indicate the accumulation of bulky moist unabsorbed residue in the lower gut which in such conditions evacuates regularly and completely, thus preventing the absorption of toxic waste products, and promoting optimum conditions of health; it is suggested that a properly functioning lower gut is associated with the absence of the feather picking vice; the foods of greatest utility in this connection are those which not only absorb much water, but, by their nature, hold it in their undigested residue as the materials move along the small and large intestines to the rectum.

8. When litter is supplied, chickens, by the consumption of part of it regulate to an extent the physical character of their dietary; birds on pasture can effect this regulation to a much greater extent; birds kept in confinement without litter or pasture must be provided with a dietary complete not alone from the chemical but also from the mechanical aspect.

9. While it is clearly recognised that the presence in a dietary of all the numerous food ingredients is necessary to prevent feather picking the matters collectively referred to in the term " bulk " definitely constitute another factor.

The assistance given by Mr. B. J. Senior, M.Sc., in determining the fibre content of the foods and in the photography is gratefully acknowledged. During the earlier part of the investigation Mr. D. Philpott, M.Sc., who then worked as a colleague of the senior author (E. J. S.) gave very valuable advice and assistance for which kind appreciation is expressed.

REFERENCES.

1. Sheehy : Sc. Proc. Roy. Dub. Soc. 21 (N.S.) No. 29 (1935)
2. Rhys : Scot. Jr. Agric. 16, 346 (1933).
3. Morris Thompson and Heller : Poultry Sc. 11, 219 (1932).
Kaupp and Ivey : N. Carolina Agr. Exp. Stn. Tech. Bul. No 22 (1923).
Halnan : Jr. Agric. Sc. 16, 451 (1926).
,, ,, ,, 18, (421) (1928).
Fraps : Texas Agr. Exp. Stn. Bul. 372 (1928).
Henning : Die land Versuch Stat. (1928).
4. Tomhave and Mumford : Delaware Agr. Exp. Stn. Bul. 172 (1931).
5. Oklahoma Agr. Exp. Stn., Rept. for period June, 1934 June, 1936 P.87.
6. Miller, Wayne and Bearse : Poultry Sc. 16, 314 (1937).
7. Cruickshank : Jr. Agr. Sc. 27. 308 (1937).
8. Sheehy : Rept. of 4th World's Poultry Congress paper no. 42 (1930).
9. Shaw and Fisher : Jr. Min. Agr. (England) 40, 327 (1933).
10. Roberts and Carrick : Poultry Sc. 13, 135 (1934).
11. N.I. Min. Agr. Monthly Rept., April, 1936. Vol. 10. No. 12.
12. Fangauf : Rept. of 5th World's Poultry Congress, Vol. 4. 50 (1933).
13. Kennard : Ohio Agr. Exp. Stn. Bul. 431.
Kennard and Bethke : Ohio Agr. Exp. Stn.. Bul. 446.
14. Eggs : successive issues.
15. Taylor and Lerner : Poultry Sc. 18, 328 (1939).
16. Platt and Geircke : Poultry Sc. 10, 396 (1931).
17. Purdue Agr. Exp. Stn.. Rept. for year ending June, 1935.
18. Eggs : 34 no 25 p. 664 (June 17. 1936).
19. Miller and Bearse : Poultry Sc. 17. 466 (1938).
20. Sheehy and Senior : Jr. Dep. of Agric. (Eire) 36, 2 (1939).
21. Lippincott : Poultry Production. (1928).
22. Halnan : Rept. of 4th World's Poultry Congress p.221 (1930).
23. Halnan : Jr. Agr. Sc. 27, 126 (1937).
24. Sampson and Mussehl : Poultry Sc. 15, 304 (1936).
25. Halnan : Jr. Agr. Sc. 27, 137 (1937).
26. Oklahoma Agr. Exp. Stn. : Rept. for 1936-38 p. 157.
27. Cowgill and Anderson : Jr. Amer. Med. Assoc. 98, 1866 (1932).

(Received for publication on 2nd October, 1939).

PIG FEEDING TRIALS, 1938.

Pig feeding trials designed to compare the relative value of a bulky and a concentrated ration for the production of bacon pigs under ordinary farm conditions were conducted by Instructors in Agriculture at 30 centres in 21 Counties during 1938. Details of these trials have been published already in the Annual Reports of the County Committees of Agriculture for those Counties where the trials were conducted and consequently the purpose of this article is merely to present a summary of the results from all centres.

A suitable number of pigs was selected at each centre and divided into two groups. The pigs were distributed between the two groups so that in regard to breeding, age, weight and sex the groups were similar. At the majority of the centres the pigs selected were twelve weeks old at the commencement of the experiment, while at the remaining centres the age ranged from ten to fourteen weeks.

The rations fed throughout the experimental period were as follows :-

GROUP I

(*Bulky Ration*)

*Maize Meal Mixture	40 parts by weight.
Oats (Ground)	20 ,, ,, ,,
Pollard	30 ,, ,, ,,
Bran	10 ,, ,, ,,
Separated Milk	4 pints per pig daily.

GROUP II.

(*Concentrated Ration*).

*Maize Meal Mixture	70 parts by weight.
Pollard	30 ,, ,, ,,
Separated Milk	4 pints per pig daily.

* The maize meal mixture contained as admixture ground barley or dehulled oats.

The meals were moistened before feeding and were fed in a sloppy condition. Each group received as much of the prescribed ration as it could consume at each meal throughout the experimental period. The pigs were disposed of as they reached bacon weights and the experiment was continued until all the animals were ready for the bacon factory. Ample supplies of drinking

water were provided and, apart from the difference in feeding, both groups were treated exactly alike.

The pigs fed on the bulky ration appeared to have better appetites and to thrive better in the earlier stages of the trial than those fed on the concentrated ration. Towards the end of the trial the animals in Group II increased in weight more rapidly and were finished somewhat sooner than those in Group I. As regards palatability, both rations proved quite satisfactory and in this respect there was little difference between them. At two centres the experiment had to be abandoned owing to the development of illness amongst the pigs, while at one other centre two pigs had to be removed from each group for a similar reason.

Details of the progress of each group are shown in Table I.

TABLE I.

Group	Total No. of Pigs in Experiment	Average Live Weight at beginning of Experiment	Average duration of Experiment	Average Live Weight at end of Experiment	Average Live Weight increase	Average Daily Live Weight increase	Average Dead Weight	Average percentage Dead to Live Weight	Average Meal Equivalent Consumed per lb Live Weight Increase
		c. q. lb.	days	c. q. lb	c. q. lb	lb	c. q. lb.		lb
I	168	0 2 0	99	1 3 7	1 0 26	1.43	1 1 16	76.1	4.31
II.	168	0 2 0	98	1 3 10	1 1 1	1.44	1 1 12	77 1	4 27

It will be observed from Table I that, on the average, the animals in both groups made very similar progress during the experimental period. Moreover, the amount of meal equivalent required to produce 1 lb. live weight increase was also very similar for both groups.

The main object of the trials was to ascertain the effect of the two types of ration used on the quality of the carcase. Hence, where possible the pigs were disposed of to a bacon factory and a report on the grading of the carcases secured. Grading returns were obtained in respect of 237 pigs, comprising 120 from Group I and 117 from Group II. These are set out in Table II.

TABLE II.

GROUP I.

Class	Number of Pigs	Number of Carcases in each Grade				Percentage of Carcases in each Grade			
		Bonus Grade	Grade A	Grade B	Grade C	Bonus Grade	Grade A	Grade B	Grade C
I.	89	4	48	24	13	4.49	53.93	26.97	14.61
II.	20	-	5	6	9	—	25	30	45
III.	11	—	8	2	1	-	72.73	18.18	9.09
IV. (non-graded)	7					—	-	-	-
	*120	4	61	32	23	3.33	50.83	26.66	19.17

*Number of pigs in Class IV not included.

GROUP II.

Class	Number of Pigs	Number of Carcases in each Grade				Percentage of Carcases in each Grade			
		Bonus Grade	Grade A	Grade B	Grade C	Bonus Grade	Grade A	Grade B	Grade C
I.	84	6	34	24	20	7.14	40.48	28.57	23.81
II.	22	—	3	8	11	—	13.63	36.37	50.00
III.	11	—	8	2	1	—	72.73	18.18	9.09
IV. (non-graded)	10	—	—	—	—	—	—	—	-
	*117	6	45	34	32	5.13	38.46	29.06	27.35

*Number of pigs in Class IV not included.

It is apparent from Table II that only a small proportion of the pigs in either group qualified for Bonus Grade. On the whole, the pigs in Group I gave the better grading results. This group contained a higher proportion of Grade A carcases than Group II. The proportion of Grade B carcases was more or less equal in both groups, while the proportion of Grade C carcases was much lower in Group I than in Group II.

Although definite conclusions cannot be drawn from one set of trials, the returns clearly demonstrate that the ration composed mainly of home-grown cereals and their by-products not only proved efficient and suitable for fattening pigs but also produced a better type of carcase for conversion into bacon than the ration composed mainly of maize.

These results are of particular importance at the present time and serve to demonstrate that a wider range of home-grown cereals and their by-products can be used with advantage in the fattening of pigs.

GALWAY SHEEP.

BY

T. Cotter, B.Sc., A.R.C.Sc.I., Instructor in Agriculture, Co. Galway.

The limestone land of County Galway is particularly suited to the breeding and rearing of sheep. For centuries landowners in that county and in other parts of the west of Ireland have derived a considerable portion of their income from this branch of livestock farming. Over half-a-million sheep

REGISTERED FLOCK OF GALWAY EWES

are kept in County Galway and of these approximately 50 per cent. are breeding ewes, nearly all of which are of the native white long-woolled breed. Generally one or two crops of lambs are taken before the ewes are disposed of for the breeding of early lambs in the midlands and eastern counties. Ewe lambs are retained on the farms in sufficient numbers to replace the drafted two and three-year-old breeding ewes. Apart from the trade in breeding stock, large numbers of store sheep and lambs leave annually for other parts of the country.

In the past, the sheep population was made up principally of large flocks on grazing ranches. With the breaking up of these lands into small holdings the numbers kept have not suffered any serious reduction; suitability of the soil and a sheep-farming tradition are more important than the area of the farm. On the light limestone and gravelly soils, which naturally give a

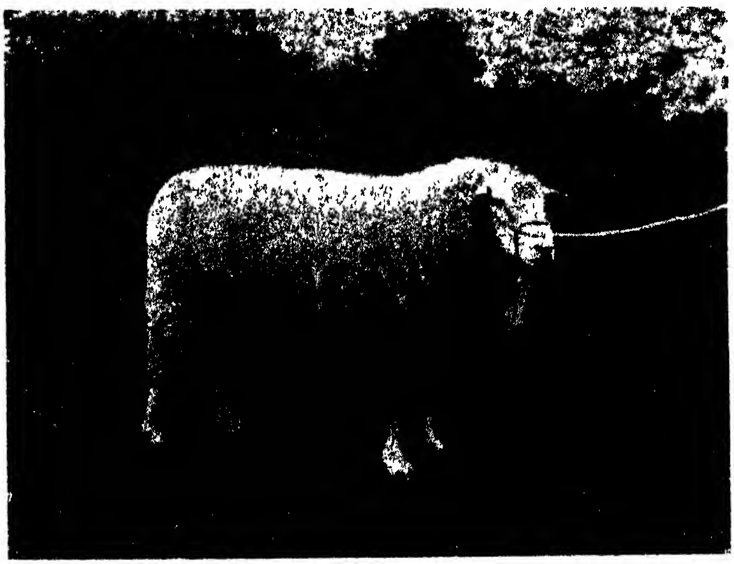
scanty pasturage, grazing with sheep is essential if the quality of the herbage is to be maintained and improved. Where second-class and inferior grazing land is improved by the application of phosphatic and other manures, sheep respond quickly to the increased fertility.

The Galway breed possesses a number of valuable characteristics. The sheep are exceptionally thrifty and sound. Even when run thickly on the land they are easily managed on small farms and are comparatively free from footrot and maggot fly attack: the ewes are prolific and make very good mothers; the lambs are strong at birth and are easily reared; and the weight and quality of the carcase are suitable for modern requirements. The wool is of fine texture and covers the whole body well and evenly. It is a matter of primary importance to farmers in County Galway and to the sheep trade of the country that these characteristics should be preserved and improved. The breed adapts itself to all classes of land and to all systems of farming. Flocks do well on the light soils in tillage districts where hay and occasionally roots and oats are fed during the winter and spring months when the pastures are bare, while on the more fertile lands the sheep of all ages thrive on grass alone.

A feature of modern sheep farming is the marked increase in the production of early fat lambs. For this purpose it is generally recognised that it is necessary to have a foundation stock of hardy deep-milking ewes to cross with rams of the Down and other breeds. All over the country the Galway sheep have been largely used in this way and have given excellent results. In certain districts, however, within the county this practice has resulted in the deterioration of the foundation stock as a number of the unsaleable cross-bred ewe lambs are retained for breeding purposes. The indiscriminate use of foreign blood in districts where large numbers of breeding stock are raised is likely to do permanent damage. Fortunately the use of Down rams in Galway flocks is not so common as it was some years ago because farmers found that on land where cross-bred stock could not be sold fat the native sheep were more profitable. At local fairs there is an increasing demand for the right type of Galway breeding ewe and for white lambs and hoggets for wintering.

There is a certain amount of variation in the size of the sheep bred in different districts. The largest types are found in the Loughrea and Ballinasloe areas and in the parts of the county adjoining Roscommon. Specimens of this type produce a dressed carcase of from 90 to 100 lb. at one and a half years old. Smaller and more compact sheep are favoured on the lighter soils, such as the land which extends in a wide belt between Gort and Dunmore. Hoggets from this area kill at weights of from 70 to 80 lb. In recent years thick, short-legged sheep of the lighter type are in greater demand by breeders and feeders in the midland, eastern and southern counties, as they are best adapted to local conditions of soil, climate and management.

Since the formation of the Galway Sheep Breeders' Society in 1923, there has been a marked improvement generally in the quality of the breed. As a result of the work of this association of breeders many farmers are building up improved flocks which should prove of great value in future years. The Society aims at producing an early maturing sheep which is easily fed and is saleable at all ages ; the type of animal desired is of medium size, with a wide, deep, compact and well-balanced body carried on short legs, having the back level and broad throughout its length and the hind quarters fleshed well down. With this object in view, an annual inspection of breeding ewes and rams is carried out by judges appointed by the Society, and the sheep that reach the required standard are entered in the Flock Book. Any farmer who wishes to join the Society and undertake the methodi-



REGISTERED GALWAY RAM

cal improvement of his flock can have his sheep inspected on his farm when his breeding flock is complete in Autumn.

Large numbers conform to the required type in both the pedigree and non-pedigree flocks in every district in the county and, by rigidly excluding unsuitable animals from the breeding flocks, every farmer can help in maintaining the reputation of the breed for excellence and quality. At the time of its formation the Society was fortunate to be in a position to make selections from large numbers of foundation stock possessing quality and constitution and suited to the particular conditions of farming and climate under which they were kept. The pedigree flocks of to-day are noted for the production of excellent mutton and wool and for the characteristics which, in the past, have made the breed of such

great economic importance. While the main object of the Society is the development of a well-fleshed, early maturing sheep, it is recognised that wool is a valuable source of income to the breeder and a product which supplies the raw material for one of our principal industries. Particular attention has been paid to improving the quality and quantity of the wool produced by sheep of the Galway breed. When ewes and rams are being inspected for registration, only those with wool of fine texture, good body and broad staple are selected. In this climate this type of fleece affords the best protection as it prevents the rain and wind from penetrating to the skin. It makes satisfactory weights and fetches the highest price.

It is estimated that about 7,000 rams of the Galway type are used for breeding in the county. When a change of blood is desirable breeders can now purchase pedigree sires, the descendants of good, pure-bred rams. The Society holds an Annual Sale at Athenry in September at which high-class pedigree rams may be procured by breeders for the grading up of their flocks. In addition, considerable numbers of ram lambs are disposed of privately or sold at local fairs.

Of all our farm live stock the sheep is the least dependent on imported feeding stuffs. The mixed system of farming practised in County Galway is well suited for the production of sheep of high quality. Healthy and thriving flocks are most easily maintained on young pastures which respond readily to dressings of farmyard or artificial manures. Supplementary feeding, such as hay, roots, and home-grown grain is available on all farms where a fair proportion of the arable land is kept under the plough.

THE EFFECT OF CERTAIN POWDER DISINFECTANTS ON THE CONTROL OF LEAF SPOT IN OATS.

BY

P. T. CARROLL, M.Sc., B.Agr.Sc.

(*Plant Breeding Department, University College, Dublin.*)

Leaf spot (*Helminthosporium Avenae sativa*) is a fungoid disease of oats. It was first described in 1889 by Briosi and Cavara, two Italian investigators, who found the disease on oat crops grown in Italy during that year. Its occurrence has since been reported by workers in several other countries including Denmark, Scotland, England, Germany, the U.S.A. and this country, and it is evident that it is one of the most serious and widespread of the fungoid diseases of the oat crop.

Descriptions of this parasite, its mode of attack, and the characteristic appearance of infected oat plants have been published by O'Brien and Prentice (1), by Turner and Millard (2) and more recently by McKay (3). These and other investigators have demonstrated that leaf spot may attack intensively the oat crop at two stages in its development. The first or primary attack, which is the more serious of the two, occurs on the young oat seedlings, while the second infestation takes place when the oat plants have nearly completed their vegetative growth and are about to open their flowers. This latter attack does not result in the death of the host plants: but it is, nevertheless, of great importance inasmuch as it infects the developing grain and thus ensures the continuance of the disease from one generation to another.

The primary infection of leaf spot has been described by McKay as follows: "The disease, as is known, is seed borne; and primary infection may apparently arise either from conidia attached to the glumes or from resting mycelium in the cells of the glumes and pericarp. The presence of disease in the seedlings may be detected as early as the third day after they appear above ground; but when it occurs as soon as this the seedlings seldom survive. About eight days after emergence, plants may be noticed which develop pale green areas about one-quarter of an inch long at the tip of the first leaf, or less frequently at one or both of its margins. Dark reddish spots rapidly develop in these pale areas, and a stripe forms either down the centre of the leaf or at its edge, resulting in the death of the tissues involved. Most of the primary lesions are at the tip or edge, and isolated spots in the centre of the leaf are usually of secondary origin. Many of the

primarily attacked leaves are completely killed within the first month, or about one-fourth of their basal portions may survive. The parasite fructifies freely on the dead areas, and at this stage the secondary spread to new leaves and to previously healthy plants is rapid. As new leaves are produced they are successively attacked with the result that they may more or less succumb. Lesions of all sizes and types are now present, varying from brown dead spots less than 1 mm. in diameter, occurring singly or in numbers scattered over the blades, to elongated strips involving one-half or more of the centre or edge of the leaf. Most of these strips originate from the coalescence of a number of separate spots. The spots and strips which develop on the new foliage are at first reddish purple in colour, the centre of the spot then becomes pale and finally brown, and the purple colour is confined to the margin."

Leaf spot spreads very rapidly through the oat braird during the month of April and early May. When, however, the climatic conditions are at the optimum for rapid vegetative growth a large proportion of affected plants will succeed in 'growing away' from the disease, and it is generally found that the fourth and subsequent foliage leaves of surviving infected plants are healthy.

It is naturally to be expected that oat plants which have lost as many as three of their foliage leaves through disease cannot compare favourably, either in vigour of growth or final yield, other things being equal, with corresponding plants which have had the advantage of a full complement of healthy leaves during their vegetative development. It has been demonstrated that infected oat plants tiller badly, are often-times stunted in growth and give a much smaller yield of dressed grain than healthy plants grown under similar conditions. In the small scale quantitative experiments carried out in 1932 and 1933 on the Albert Agricultural College farm the average yield of dressed grain per plant of healthy and diseased plants, *i.e.*, plants primarily infected, is set out in the following table.

TABLE I.

Year	Average Weight of Dressed Grain.		Ratio Healthy : Diseased, taking Healthy as 100
	Healthy Plants	Diseased Plants	
	Grams	Grams	
1932	3.39	1.42	100 : 42
1933	4.24	2.92	100 : 69

None of the varieties of cultivated oats (A. *sativa*) at present on the market is completely resistant to attacks of leaf spot disease. It is evident,

however, that all varieties are not equally susceptible. In counts made in 1933 and 1934 on field plots of oats grown on the College farm the following results were obtained :

TABLE II.

Variety	Percentage of Infected Plants	
	1933	1934
	Per cent.	Per cent.
Glasnevin Success ..	9.0	4.25
Victory II	12.5	1.5
Glasnevin Ardri ..	7.7	1.2
Glasnevin Sonas ..	0.5	Trace
Potato	2.5	3.4
Sonas Marvellous ..	1.0	1.0

Glasnevin Sonas oats, which is a very prolific grain-producing type, is remarkable in that the percentage of infected plants is always very low. It is in fact rather difficult to obtain a badly infected plant in a crop of this variety. McKay (*loc. cit.*) observes that the foliage of Glasnevin Sonas shows resistance since the killing of the leaves and the development of brown spots and streaks are not nearly so common as in other varieties examined by him. On the other hand Glasnevin Sonas sometimes gives a poor plant establishment, and the presence of the mycelium of leaf spot on seedlings which have failed to come overground has been demonstrated. It may therefore be that this variety, while being resistant in the green leaf stage, may be rather susceptible in the early stages of germination.

In some cases of infestation with leaf spot the young oat seedling is so severely attacked during germination that the infected plant will not come overground. The shoots of these plants which have become severely infected at this period lose their capacity for erect growth ; they grow in a horizontal or spiral direction until they succumb. If therefore the seed be heavily infected with leaf spot and the conditions during germination be cold and wet a poor establishment may be expected even although the germination of the grain as determined in the laboratory may have been quite satisfactory.

A simple and fairly effective method of reducing the percentage of infection by the primary stage of leaf spot is by late sowing. The young oat seedlings offer a strong resistance to the disease, and apparently the period

during which the young shoot is incapable of preventing the invasion of the mycelium is, under favourable conditions, very limited. The more rapid the growth the shorter does the susceptible period become, whereas if the crop is sown under cold, damp conditions, germination is unduly prolonged and the period of susceptibility correspondingly increased. The mycelium of leaf spot is not so susceptible to cold as the young oat shoot, and Ravn (4) a Danish investigator, has demonstrated that the fungus could make progress even at a temperature as low as 3–5°C.

This method of control cannot, however, be effectually employed where attacks of Frit Fly (*Oscinis frit*) are prevalent. This insect pest attacks young oat plants about the end of May and frequently causes very serious damage to late-sown oat crops. The farmer is therefore, in respect of the time of sowing his oat crop, between two stools. Under ordinary circumstances he may reasonably expect to minimise losses from leaf spot on the one hand and 'frit fly' on the other by seeding his oat crop not earlier than the beginning nor later than the middle of March.

A more promising method of controlling effectually the incidence of leaf spot is by the disinfection of the seed previous to sowing. During recent years several organic mercuric preparations suited for the dressing of all kinds of seed grain have been put on the market. Some of these disinfectants can be applied in powder form. They have proved to be equal in disinfectant efficiency to the older dressings—Copper Sulphate and Formalin solutions—and are superior to the latter in ease of application. Moreover, they have none of the many disadvantages associated with wet dressings, and when applied to the grain in the proportions recommended by the manufacturers they appear to stimulate rather than retard germination and subsequent field establishment.

In one series of experiments which were carried out on a large scale in the South-West of Scotland during the year 1930 O'Brien and Prentice found that home-produced seed treated with Ceresan gave an increased establishment of 91 per cent. over that of untreated seed, and in addition the number of diseased plants in the braird was decreased from 28 per cent. in the case of the untreated seed plots to 4 per cent. in the case of plots treated with Ceresan. The results of the small-scale experiments with seed disinfectants carried out at the Albert Agricultural College in 1932 and 1933 which are set out in the following tables confirm those of O'Brien and Prentice, especially in regard to the great decrease in the number of diseased plants brought about by seed treatment; but the differences in establishment which were obtained while significant in each year are much less marked than those obtained by the Scottish workers referred to. This may possibly have been due to our presumably more favourable weather conditions during germination.

TABLE III.

1932. Means of Six Plots. 108 Grains per Plot.

Variety	Establishment		Number of Infected Plants in Braird	
	Ceresan treated	Un-treated	Ceresan treated	Un-treated
Victory (ex Scotland, 1931) ..	98.7	85.7	0.50	5.50
Victory II (ex A.A.C., 1931) ..	100.0	84.3	1.83	16.60
Glasnevin Sonas (ex A.A.C.,1931)	92.0	65.5	0.0	1.16

In the 1933 experiments it was decided to include, in addition to Ceresan, two other powder dressings, viz. :—Agrosan G, and Preparat 413 (Alvit) in the treatment trials. The varieties included were : Glasnevin Sonas, Glasnevin Success and Sonas-Victory II. The experimental lay-out was a 6 x 12 semi-latin square. The results obtained for establishment are set out in the following table (Table IV). One hundred and eight grains were sown per plot.

TABLE IV.

Mean Establishment. 1933.

Variety	Treatments				Variety Means (24 Plots)
	Ceresan	Agrosan	Alvit	Untreated	
Glasnevin Sonas ..	97.5	103.0	97.5	94.50	98.12
Glasnevin Success ..	101.83	101.67	97.83	99.50	97.58
Sonas Victory II ..	102.83	101.16	102.33	89.33	98.79
Treatment Means (18 Plots)	100.89	101.94	99.22	91.11	—

The treated plots gave significantly better establishment than the untreated plots. There was, however, no difference between Ceresan, Agrosan and Alvit in regard to their effect on establishment in this experiment.

The mean number of primarily infected plants in the braird is set out in the following table.

TABLE V.

Mean Number of Primarily Infected Plants per Plot, 1933.

Variety	Treatments: Ceresan	Agrosan	Alvit	Untreated	Variety Means (24 Plots)
Glasnevin Sonas ..	0.017	.017	.000	.033	.016
Glasnevin Success ..	1.50	5.50	1.33	20.83	7.29
Sonas Victory II ..	1.17	4.00	0.50	13.50	4.79
Treatment Means (18 Plots)	0.95	3.22	0.61	11.45	--

The treatments significantly reduced the average number of infected plants in the braird of each plot.

The effect of the dressings on the average yield of dressed grain per plot in the small scale quantitative experiments was much less than anticipated. The results are set out in the following tables :

TABLE VI.

Means of Six Plots, 1932.

Variety	Average Yield of Dressed Grain per Plot: Plots treated with Ceresan	Untreated (Control)
	Grams	Grams
Victory, Seed ex Scotland, 1931	233	224
Victory II	253	278
Glasnevin Sonas	213	199
Mean of three Varieties ..	233	234

TABLE VII.

Mean Yield of Grain (grams), 1933.

Variety	Treatments				Variety Means (24 Plots)
	Ceresan	Agrosan	Alvit	Untreated	
Glasnevin Sonas	268.7	253.5	265.2	245.5	258.2
Glasnevin Success ..	374.3	391.0	401.8	358.0	381.2
Sonas Victory II ..	355.5	357.3	359.7	346.7	354.8
Treatment Means (18 Plots)	332.8	333.9	342.2	316.7	

It will be noted that there was no difference between treated and untreated in the quantitative experimental plots carried out in 1932. There was, however, a slight difference in favour of treatments in the 1933 experiments; but this difference being less than the experimental error cannot be regarded as significant.

The effect of dry seed dressings on the control of the disease was again tested in 1937, care being taken on this occasion to obtain seed which was known to be very heavily infected with leaf spot. Ceresan, Agrosan and Abavit were tested against a control -untreated seed in a four by four latin square. The plots were in this trial 20 sq. feet in area (5 ft. x 4 ft.) and two hundred and seventy-nine grains were sown in each plot. The seed was sown on the 1st April, 1937, under good dry conditions, and the seedlings appeared overground on the 15th April, 1937. For a considerable period it was possible to pick out the untreated plots at a distance owing to the relatively greater thickness of stand and to the freedom from disease of the constituent plants of the treated plots. Counts of established plants were made on 28th April, 1937, and in the following Table the arrangement of the plots, the seed treatments and the number of established plants per plot are set out:

TABLE VIII.

Treatments:

1 Ceresan: 2 Abavit: 3 Agrosan: 4 Control.

2 260	4 241	1 279	3 276
3 257	1 276	2 269	4 252
4 244	2 261	3 271	1 266
1 254	3 262	4 240	2 267

The figures for the treatment totals are :

Ceresan	..	1,075.	Established plants.
Agrosan	..	1,066	do.
Abavit	..	1,057	do.
Control	..	977	do.
		S.E. (four plots) + 12.5.	

An analysis of variance of these figures shows a significant difference between the treated and the non-treated seed, but no significant difference exists between the three treatments as regards the number of surviving plants. The number of diseased plants in the treated plots averaged less than 1 per cent., while the number showing disease spots was as high as 42 per cent. in the untreated plots. The laboratory germination of the sample of untreated seed was 97 per cent.

The grain ripened with little or no damage, and the yield of dressed grain was obtained for each plot on the 11th August, 1937. An analysis of the figures showed a significant difference between the treated and non-treated plots ; but no significant difference between the three treatments, Ceresan, Agrosan or Abavit. The total grain yields were :

Ceresan	..	5,410 grams.	Abavit	..	5,200 grams.
Agrosan	..	5,185 ,,	Control	..	4,103 ,,
		S.E. (four plots) + 131.2.			

These figures show that the average increase of dressed grain due to seed treatment was approximately 25 per cent.

The experiment was again repeated in 1939 and Star oats (ex Scotland) was again used. This particular sample was found to carry approximately 20 per cent. infected grain. On this occasion a new Abavit powder (Abavit T.B. 910) was used. The latin square arrangement of the plots was again employed, and two sowings were made : one early in February and the other late in March so as to determine the possible effect of the different weather conditions experienced during germination and early growth on the establishment and on the percentage of disease both in the control and treated plots. Two hundred and sixty-one grains were sown per plot. The first sowing was made on the 13th February, 1939, and the second sowing on the 31st March, 1939. The plants came over ground on the 10th March, 1939, and 16th April, 1939, respectively, and counts of diseased plants and total surviving plants were made at intervals. Final establishment counts for the first and second sowings were made on 24th April, 1939, and 12th May, 1939, and the following tables give the numbers obtained for each plot :

TABLE IX.

Establishment Counts.

No. 1.—Sown 13th March, 1939. Counted 24th April, 1939.

Treatments.

1.—Ceresan; 2.—Agrosan; 3.—Abavit, T.B. 910; 4.—Control.

2 192 (0)	3 205 (1)	4 186 (35)	1 228 (0)
1 204 (0)	4 185 (18)	2 218 (0)	3 208 (1)
3 216 (0)	2 209 (2)	1 212 (0)	4 169 (28)
4 179 (29)	1 216 (1)	3 215 (0)	2 215 (0)

Figures in brackets give the number of diseased plants per plot.

TABLE X.

No. 2.—Sown 31st March, 1939. Counted 12th May, 1939.

3 208 (0)	1 200 (0)	2 198 (0)	4 170 (33)
1 204 (0)	4 181 (24)	3 196 (0)	2 184 (1)
2 195 (0)	3 205 (0)	4 170 (22)	1 219 (0)
4 176 (23)	2 201 (0)	1 199 (0)	3 202 (0)

Figures in brackets give the number of diseased plants per plot.

TABLE XI.

Treatment Totals. (Establishment).

	Ceresan	Agrosan	Abavit T.B. 910	Control	Average Increase of treated Plots over Control	S.E. (4 Plots)
					Per cent.	
No. 1	860	884	844	719	17.6	±21.6
No. 2	822	778	811	697	15.2	±16.8

TABLE XII.

Diseased Plants.

	Ceresan	Agrosan	Abavit	Control
No. 1	1	2	2	110
No. 2	0	1	0	102
Total	1	3	2	212

The low establishment of the untreated plants was due to the failure of some of the diseased plants to come above ground—thus reducing the percentage visible infection. Although some of the most severely attacked plants which succeeded in coming overground had died when these counts were made (fourth-leaf stage) an accurate record of the total number which brairded was ensured owing to the precaution having been taken of marking each diseased plant with a peg as it appeared. The figures obtained show that the treatments considerably increased the number of established plants over those obtained for the untreated seed; but no significant difference was obtained for any treatment over another as regards establishment or number of diseased plants, all three treatments having controlled the disease effectively.

The plots sown on 31st March suffered severe damage from an attack of Frit fly (*Oscinis frit*) and as this circumstance vitiated the results, it was not thought desirable to record them.

The following table shows the yields of dressed grain per plot for the first or No. 1 sowing :

TABLE XIII.

Dressed Grain. No. 1 (Grammes).

Treatments.

1.—Ceresan ; 2.—Agrosan ; 3.—Abavit. T.B. 910 ; 4.—Control.

2 1,478	3 1,173	4 905	1 1,264
1 1,406	4 1,031	2 1,043	3 1,226
3 1,485	2 1,126	1 996	4 1,019
4 1,393	1 1,205	3 1,157	2 1,234

TOTALS.

Ceresan	Agrosan	Abavit T.B. 910	Control	S.E. (4 Plots)
4,871	4,881	5.011	4,348	± 83.6

These figures show that the seed treatments increased the yields of dressed grain over that obtained from the control plots to the extent of approximately thirteen per cent. The analysis of variance shows that this result is significant. There was again no significant difference between the different treatments either in regard to disease control or productivity of the crop.

RELATION BETWEEN WEATHER CONDITIONS AND INFECTION OF OATS WITH LEAF SPOT.

The amount of infection present in a particular oat crop depends directly on the degree of infection of the seed sown. This latter is, however, very much influenced by the weather experienced during the flowering and subsequent development of the grain, and as climatic conditions vary from district to district it might be expected that seed drawn from different areas would produce crops showing varying amounts of primary infection with leaf spot. In order to get an idea of how the percentage infection of seed oats varied for different areas of this country, samples were obtained from nine different districts throughout the country in the spring of 1937, and

grown with Glasnevin-grown seed and Scotch seed as controls. Half of each sample was treated with Ceresan, and sowings of treated and untreated grain were made ; but as cold, wet weather immediately followed, the soil got waterlogged and very little reliance could be placed on the results obtained, but they tended to show that seed coming from the southern and western districts carried more infection than did the Glasnevin seed.

This experiment was again repeated in 1939 with seed from Clonakilty, Co. Cork ; Ballyhaise, Co. Cavan ; Portlaoighise, Laoighis ; and County Dublin. The seed from Scotland which had been used in the latin square trials was included as a control. The highest infections were found on Potato oats from Ballyhaise, which showed 15 per cent. primarily infected plants. One sample from Clonakilty gave a poor stand for the untreated seed and a high percentage of infected seedlings. In this case many of the infected seedlings failed to come overground, and the stand of plants was approximately only one-third of that from the treated sample. The seed from Laoighis came next in percentage infected plants, while very little showed on any of the Dublin-grown seed, except on a few plants of the varieties Glasnevin Success and Glasnevin Sonas. The degree of primary infection shows a close relationship to the general weather conditions, the highest primary infection being found in seed originating from the high rainfall districts.

GENERAL DISCUSSION AND RECOMMENDATIONS.

These results, in so far as they are representative of what would occur under ordinary field conditions, indicate that the treatment of seed oats for the control of leaf spot, while controlling that disease effectively, may not in all cases result in a high increase in the yield of dressed grain, under conditions similar to those obtaining at Glasnevin in circumstances where the amount of infection on the seed grain or the conditions during germination, or both, are such that the plant establishment resulting from untreated seed is not reduced below, say, eighty per cent. of that from treated seed. Under those conditions the surviving plants of the untreated plots, by making relatively greater growth may be able to utilize fully the available plant food in the soil and thus succeed in bringing up the yield per plot. When however the percentage of infection of the seed sown is high, significant reductions in yield may be expected if the grain is not dressed before sowing. Treated seed may be sown more thinly than is usual for any particular district as it is a general rule that after treating with any of these powder dressings the resulting brairds are thicker than those from untreated seed, and there is the consequent danger of loss due to lodging.

It is often stated that these powder dressings have a direct stimulating action on growth of the young seedlings, but there is very little evidence in support of this. This 'stimulating' effect which results in the better

braírds obtained from dressed seed is probably due to the fungicidal properties of the dressings in the control of moulds and other disease organisms, both on the grain, and in the soil in the immediate neighbourhood of the grain. In testing treated and untreated samples of grain for germination on moist blotting paper in Petri dishes and in sterilized sand it is the general rule that the untreated samples become covered with moulds after a short period, while the treated samples are free from such attacks. The germination of the untreated samples is generally lower than that of the treated samples, and this is more pronounced when dealing with samples of badly harvested grain of poor or mediocre germinating capacity. These moulds, etc., on the surface of the grain have a retarding influence on the growth of the young seedling by feeding on the constituents of the sprouting grain. It has been a common experience among farmers that thin braírds and the presence of dried-up sprouted grain in the soil frequently occur in seasons following bad or wet harvest conditions in the case of untreated seed even though such seed may have given good laboratory germination.

It is therefore a wise precaution even under the most favourable conditions to treat seed oats with a suitable disinfectant before sowing. It will at least provide a good insurance against excessive damage from high percentage infestation with leaf spot especially when the conditions subsequent to sowing are cold and wet. Furthermore it will enable farmers to sow earlier and thus avail of an increased growing period.

The operation of dressing the seed grain can be carried out some time prior to sowing without any ill effect and there is no risk of re-contamination. It is desirable that the seed grain and powder be thoroughly mixed so that the powder forms a thin film on the surface of the grain. The quantity recommended by the makers is sufficient and no advantage is to be gained in increasing this amount, as there is a limit to what the surface of the grain will efficiently hold. It has been stated that dressings of these organic mercury dusts cause some injury to the stored grain, but the experience at the Albert Agricultural College has been that samples of wheat treated with the requisite amount of seed dressing (Ceresan) in 1935 suffered no damage after twelve months' storage.

In using dry disinfectants of this class it is desirable as far as possible to avoid inhaling the powder, which is poisonous. It is desirable that the nose and mouth should be protected by a cloth or respirator during the operation ; but if that be not possible the operation should be carried out in the open air and the machine used for the purpose of treating the grain be dust-proof. Machines for the application of these powder dressings to seed grain are now on the market ; but for the small farmer who has only to dress a limited quantity of grain, a disused end-over-end churn or barrel similarly operated and fitted with one or two baffle boards is equally effective. The least satisfactory method is the practice of spreading the grain on the

barn floor and scattering the powder over it while turning the grain with a shovel. By adopting this method it is hard to get all the grain evenly coated with a film of powder and much is wasted. The average cost of dressing seed grain works out at approximately 1s. 6d. per acre.

ACKNOWLEDGMENTS.

These trials were carried out at the Albert Agricultural College, Glasnevin

Thanks are due to Mr. M. Caffrey, University Lecturer in Plant Breeding, to whom the initiation of these trials is due, for suggestions and criticism during the course of the trials; to Mr. J. Brady, M.Agr.Sc., for his help at sowing and making counts in 1932–33; to Mr. B. Crombie, M.Sc., for his help in 1937. I am also indebted to Dr. D. G. O'Brien, West of Scotland Agricultural College, Glasgow, who supplied Star oats in 1937 and 1939; and to Mr. G. H. McLean who kindly prepared the photographs.

REFERENCES :

1. O'Brien, D. G. and Prentice, E. G.: "Leaf Stripe or Yellow Leaf of Oats." *Scottish Journ. Agr.*, xiii, No. 3, 1930.

2. Turner, D. M. and Millard, W. A.: "Leaf Spot of Oats." *Helminthosporium avenae. Annals Applied Biol.*, xviii, 1931.

3. McKay, R.: "The Incidence and Control of Loose Smut and Leaf Spot of Oats." *Journ. Dept. Agr.*, Vol. xxxii, No. 2, 1933.

4. Ravn, F. K.: "Ueber einige Helminthosporium—Arten und die von denselben hervorgerufenen Krankheiten bei Gerste und Hafer." *Zeitsch. fur Pflanzenkr.*, xi, 1901.

(Received for publication on the 30th October, 1939).

Fig. I.—Healthy Plant.

Fig. II.—Plant infected with Leaf Spot, showing spotting and shrivelling up of first and second seedling leaves.

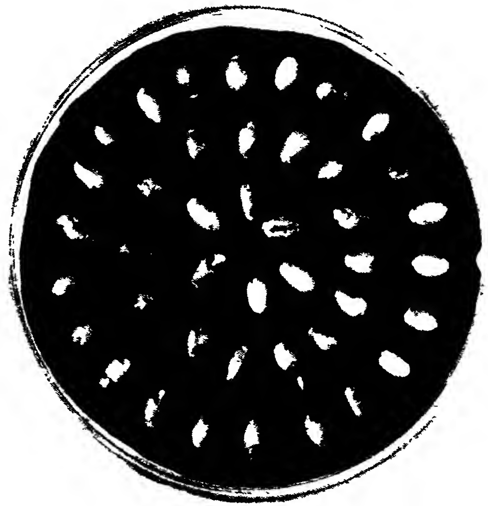


Fig. III.
Germinating grain disinfected with mercurial powder dressing.

Fig. IV.
Grain from same sample as Fig. III. (untreated) showing mould growths. Laboratory germination of sample 83%

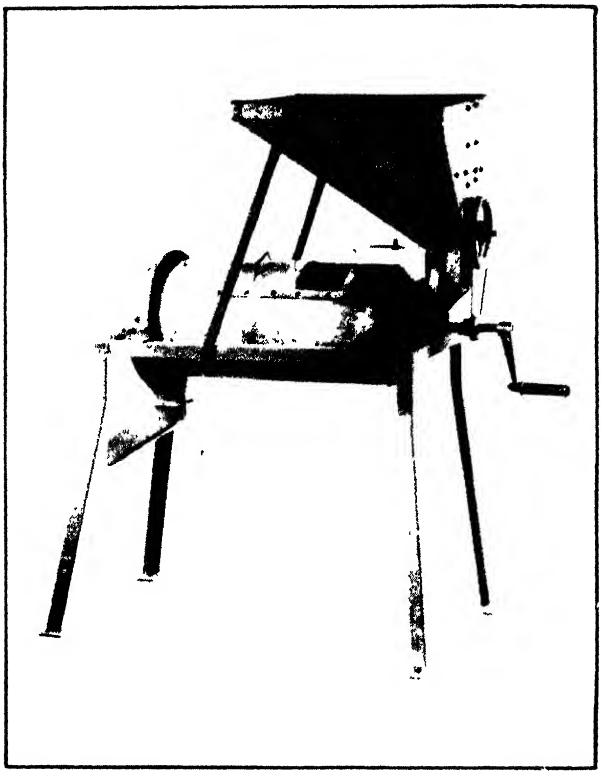


Fig. V.

Type of hand-operated machine as used for disinfecting grain with powder dressings.

AN UNUSUAL SPOTTING OF POTATO TUBERS AND ITS CAUSE.

BY

ROBERT MCKAY, B.Sc., A.R.C.Sc.I.,

Department of Plant Pathology,

Albert Agricultural College, Glasnevin, Dublin.

Some considerable time ago potato tubers showing numerous small sunken spots as illustrated in Figs. 1 and 2 were forwarded to the writer for examination. The variety was British Queen and the potatoes were part of an early digging made for seed purposes during the month of August, the affected sample being received the following December. At digging time the tubers were collected in new tomato chips which were then stored on a loft in an outhouse. When received some of the tubers showed spotting all over, but others only on one side. The spots varied in size as illustrated, the injured tissue in each case occurring around a lenticel and penetrating into the flesh of the tuber to a depth of from 1 to 4 mm.

The absence of any parasitic organism from the diseased spots and the fact that the latter occurred at the lenticels suggested that the injury might be caused by a toxic liquid or gas. However, the building in which the tubers were stored contained neither artificial manures nor chemicals of any kind and was well isolated from other farm buildings containing animals, so that the possibility of the presence of such a gas as ammonia arising from artificial manure or from stable manures was ruled out. At the same time, a few tubers showed evidence of having been gnawed by rats and the presence of the fæces of these pests in some of the chips where the spotting of the tubers was most prevalent indicated a possible explanation of the trouble. Accordingly a number of experiments was carried out to test whether any connexion existed between the rats and this peculiar spotting.

The first experiment was carried out in the month of January in an outhouse, a number of tubers being treated with a mixture of rat urine and fæces, controls being similarly treated with water. The temperature was almost down to freezing point and decomposition of the urine was slow as was also the respiration of the potatoes. The result was that only one tuber out of seven which were treated with the mixture developed lesions and these were more typical of the condition known as Pit Rot. The experiment was repeated on different occasions, both inside a room at a

temperature of 18–20°C. and later in outhouses during warm weather in the months of July, August and September. Tubers at varying stages of maturity and belonging to three different varieties, viz., British Queen, Duke of York and Up-to-Date, were used. The mixture of rat urine and fæces was applied by pouring it from a watering can over the tubers in an ordinary sprouting box, or alternatively, the tubers were dipped in the mixture and then suspended over it in a closed vessel. Rat urine alone was also used and applied to the tubers by means of a garden syringe. Injury to potato tubers occurred as a result of all these treatments, and the different types of injury so produced are illustrated in Figs. 4, 5 and 6. Sometimes a single application of the mixture or of urine alone produced lesions, and on two occasions darkening of the tissue around the lenticels was observed within sixty hours after treatment. Usually, two or three applications given at intervals of forty-eight hours were required for the production of symptoms and spotting did not generally appear until six or seven days after the first application. The worst injury occurred when immature tubers which had been kept for some time after digging were used and the experiment carried out at a temperature of 20°C., or in very warm weather. That the damage was due rather to the liquid, than to any gases evolved by decomposition or by interaction of the urine and fæces, was shown by suspending dry tubers over a mixture of rat urine and fæces in a closed vessel in which case no lesions developed.

As a net result of numerous experiments it was concluded that the spotting at the lenticels of the potato tubers as originally received was caused by rat excrement, the urine being mainly responsible.

Pit Rot was described and fully discussed in this Journal by Pethybridge.* He showed that it is not due to any parasitic organism, and that similar injury could be produced experimentally by treating potato tubers with various chemicals and gases, but that the only one of these which is at all likely to occur in a potato " pit " or clamp is ammonia.

A potato tuber showing the circular, depressed areas characteristic of Pit Rot as it occurs naturally is illustrated in Fig. 3, the attack being a medium one. The similarity of these to the lesions shown in Fig. 6 is at once apparent, and the resemblance is even more striking when Fig. 6 is compared with some of Pethybridge's original illustrations (*ibid.*). Nevertheless, in the course of the experiments described the number of tubers which showed lesions similar to Fig. 6 was very small, the majority of them showing spotting of the types seen in Figs. 4 and 5, and it is not suggested that rats are invariably responsible for the condition known as Pit Rot, as the latter occurs in the entire absence of these animals. It is clear,

* Pethybridge, G. H.: Investigations on Potato Diseases. (Tenth Report) *Journal of Department of Agriculture*, Vol. xix, pp. 271–292; 1918/19.

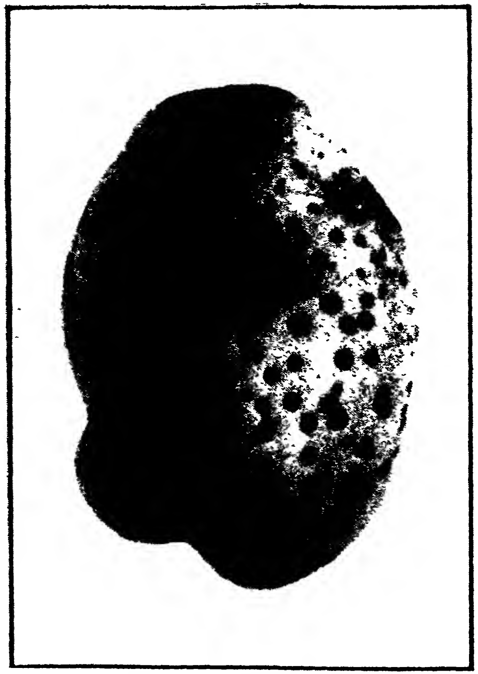


Fig. 1.

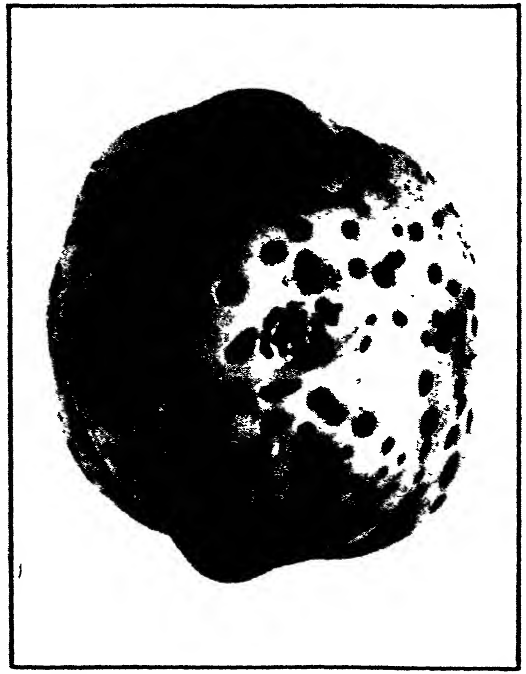


Fig. 2.

Potato tubers as originally received showing spotting at the lenticels, variety British Queen.

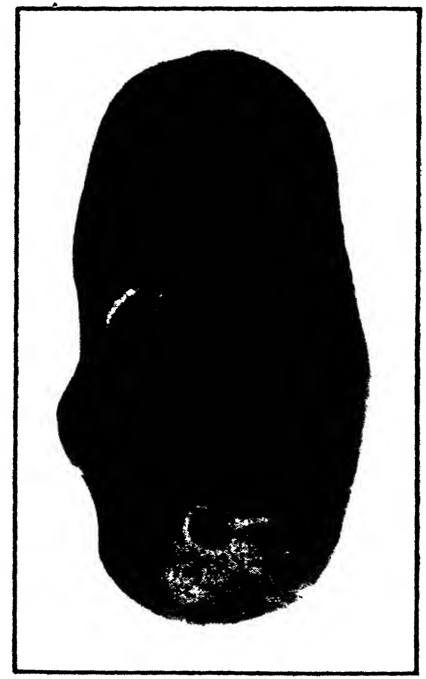


Fig. 3.

Potato tuber showing Pit Rot as it occurs naturally.

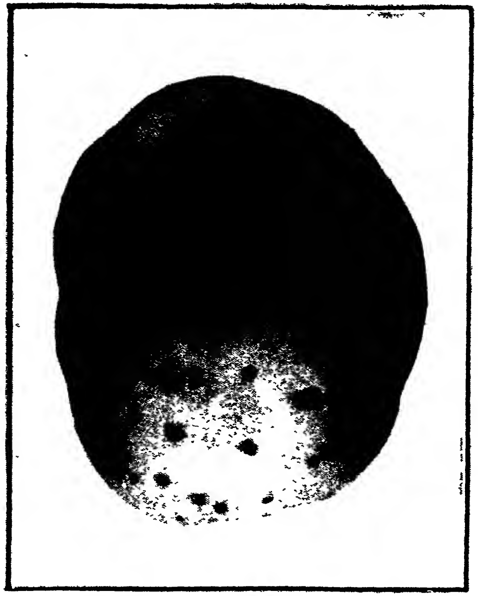


Fig. 4.

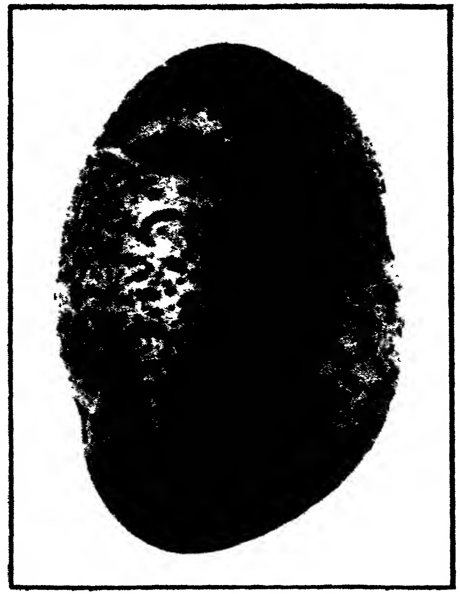


Fig. 5.

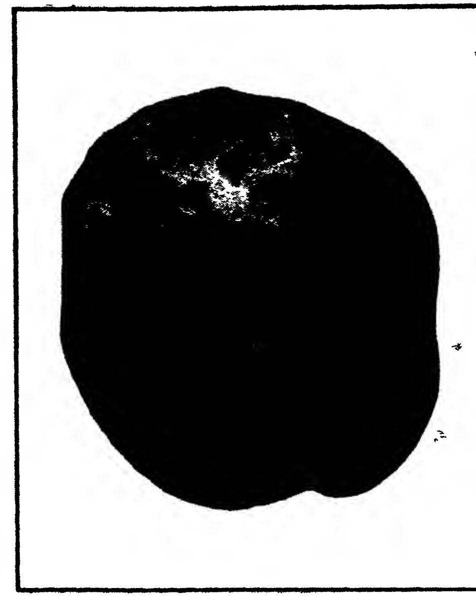


Fig. 6.

Potato tubers showing different types of injury produced by treating them with a mixture of rat urine and fæces at 20°C. fifteen days **after** treatment, variety British Queen. Note similarity of lesions on Fig. 6 to those on Fig. 3.

however, that the excrement of rats may cause injury indistinguishable from Pit Rot.

Since the publication of Pethybridge's account of Pit Rot (*loc. cit.*) very little additional information regarding it has been forthcoming and the actual cause of the disease is still unknown. Observations made by the present writer over a number of years show that it is always most prevalent following a dry autumn during which the tubers would have suffered some dessication in the ground. Such tubers are known to have a high power of absorption and consequently would be very liable to take up any liquid present in the " pit " or clamp. This might be taken as a further indication that Pit Rot may actually be due to the absorption by the tubers of some toxic liquid in the " pit."

ACKNOWLEDGMENTS.

I am indebted to Professor David S. Torrens, Trinity College, Dublin, for supplies of materials as required on many occasions, and thanks are also due to my assistant, Mr. G. H. McLean, for taking photographs of Figs. 1 to 6.

(Received for publication on the 13th October, 1939.)

FIELD EXPERIMENTS 1939.

The following report deals with Field Experiments conducted by County Agricultural Instructors in 1939. These comprise trials with varieties of wheat and oats, manurial and ripening trials with wheat and experiments with grass seed mixtures.

Details of these experiments are published in the Annual Reports issued by the Committee of Agriculture for each county, and persons who are interested may obtain a copy of the Report for any particular county by applying to the Secretary of the appropriate Committee of Agriculture.

WINTER WHEAT VARIETY TRIALS.

These trials were conducted at 61 centres in 25 counties. The varieties included were Queen Wilhelmina, Pajbjerg, Juliana and Holdfast. With regard to Queen Wilhelmina two plots were laid down at each centre, one of which was sown with original seed, imported from Holland, and the other with seed obtained locally by the Instructors, the object being to determine whether original seed of this variety was superior to the commercial stocks generally available for seed purposes.

Queen Wilhelmina has now been in cultivation in this country for a considerable number of years and is too widely known to require description.

Pajbjerg is a Danish wheat and has been included in these trials since 1936. It is characterised by short, stiff straw, white chaff and red grain.

Juliana was bred in Holland. It has somewhat shorter straw than Queen Wilhelmina, white chaff and white grain.

Holdfast was raised at the Plant Breeding Institute, Cambridge, and was included in these trials in 1938. It possesses very short, strong straw, white chaff and white grain of good milling quality.

Owing to the unfavourable weather conditions experienced during the earlier part of the sowing season, only about 20 per cent. of the plots were sown before the end of December. The germination of all the varieties except Holdfast was in general satisfactory. This variety failed to produce a satisfactory braird at approximately 20 per cent. of the centres.

Yellow Rust (*Puccinia glumarum*) attacked all the varieties at about 25 per cent. of the centres. One plot of Queen Wilhelmina (*ex* Holland) and

five of the Holdfast plots were severely attacked. At the remainder of the centres however the disease was of little consequence. Brown Rust (*Puccinia triticina*) was reported from one centre. Slight attacks of "Take All" (*Ophiobolus graminis*), mildew (*Erysiphe graminis*) and Loose Smut (*Ustilago tritici*) also occurred at a few centres. The plots were in general free from insect injury. Wireworms attacked all the plots at one centre, but the damage caused was of little consequence.

All the varieties at one centre and both plots of Queen Wilhelmina at another centre lodged slightly, otherwise no lodging occurred.

Holdfast ripened, on the average, about five days earlier than Pajbjerg and Juliana and from three to four days earlier than the Queen Wilhelmina plots. Favourable reports on the quality of the grain of all the varieties were received from the great majority of the centres.

The results which are set out in Table I show that Pajbjerg gave the highest average yield of grain and was superior to all the other varieties at the majority of the centres. This variety has been included in these trials since 1936 and it is interesting to note that it has given the highest average yield of grain each year. The average yields of Queen Wilhelmina (*ex* Holland) and Juliana were very similar. Although Queen Wilhelmina (*ex* Holland) gave a higher average yield than Queen Wilhelmina (local) it was superior to the latter at only 29 of the 61 centres. Holdfast which gave the lowest average yield was outyielded by all the varieties at the majority of the centres.

SPRING WHEAT VARIETY TRIALS.

Trials with five varieties of spring wheat were conducted at 60 centres in 24 counties during the 1939 season. The varieties tested were Red Marvel, Atle, April Bearded Red, Aurore and Diamant II.

Red Marvel and *April Bearded Red* have been in cultivation in this country for a considerable period and are too widely known to require description.

Atle is a new variety of Swedish origin and was included in these trials for the first time in 1938. It is a white-chaffed, red-grained variety, with rather short, strong straw.

Aurore is a French variety characterised by long straw, red chaff and a fairly large red grain.

Diamant II is a new Swedish variety, and was included in these trials for the first time this year. It is derived from a cross between Diamant and

Extra Kolben II. The grain is very similar to that of Diamant, but the straw is shorter than that of the latter variety.

The greater proportion of the sowings were made in March, particularly during the latter half of the month. Germination of all the varieties was in general very satisfactory. Subsequent to brairding however the dry, harsh weather experienced during late spring had an adverse effect on a number of the plots and tended to check normal development and growth. In this respect, Red Marvel and Atle appeared to suffer most. With the advent of more favourable weather conditions towards the end of June growth improved generally.

Some of the common diseases of wheat, such as Yellow Rust (*Puccinia glumarum*), Loose Smut (*Ustilago tritici*) and "Take All" (*Ophiobolus graminis*) occurred at a number of centres. With the exception, however, of a few centres where the plots of Diamant II and Aurore were rather severely attacked by Yellow Rust the damage caused by fungoid diseases in these trials was not of any consequence. Severe damage was caused by wireworms at two centres. Apart from these attacks the plots, in general, were free from insect injury.

April Bearded Red lodged slightly at twenty-one centres, Aurore at five centres, Red Marvel at four centres and Diamant II at two centres. With regard to time of ripening, Aurore ripened, on the average, four to five days earlier than April Bearded Red and Diamant II and from ten to twelve days earlier than Red Marvel and Atle. Reports on the quality of the grain were favourable from the majority of the centres. In this respect however Red Marvel appeared to be least satisfactory.

The results which are set out in Table II show that April Bearded Red gave the highest average yield and was superior to the other varieties at the majority of the centres. Diamant II outyielded Atle at 34 centres and Red Marvel at 35 of the 60 centres. Atle was superior to Red Marvel at 35 centres. The yields of Aurore and Red Marvel were practically similar.

WINTER WHEAT MANURIAL TRIALS.

Two series of manurial trials with winter wheat similar to those conducted in the 1937–38 season were carried out in 1938–39, one series on land which had been under tillage during the previous season and the other on lea. Similar manurial treatments were used in both series and the following plots were laid down at each centre :—

Plot I. No manure or lime (Control).

Plot II. Dressed with 3 cwt. superphosphate and 2 cwt. kainit (14% potash) per statute acre at time of sowing. In addition one cwt. of sulphate of ammonia was applied in spring at the discretion of the Instructor. This was done at eleven centres in Series I and at ten centres in Series II.

Plot III. Dressed with freshly-burned lime at the rate of 30 cwt. per statute acre at the same time as the mixture of superphosphate and kainit was applied to Plot II.

Series No. I.— In this series, trials were conducted at twenty-three centres in fifteen counties on land which had been in tillage in 1938. Germination was good at all centres and, with the exception of four centres where the stand was rather thin, plant establishment was generally satisfactory.

The control plots were somewhat slow to develop at eleven centres, while at eight centres the limed plots also remained somewhat backward as the season advanced. The plot dressed with superphosphate and kainit made poor growth at one centre, while those which had an application of sulphate of ammonia in addition were slow to develop at three other centres. No lodging of the crops occurred at any centre.

There was relatively little difference between the times of ripening of any of the plots at any centre. In a few cases plots dressed with superphosphate and kainit ripened some days earlier than the control and limed plots and in a few other cases plots which received a dressing of sulphate of ammonia were a few days later in ripening than the other plots.

There were no cases of serious attack by insect or fungoid pests. Slight injury was caused by wireworms at three centres, slight mildew occurred at three other centres and slight attacks of rust at four centres. The grain and straw produced were of excellent quality at all centres.

Yields of grain from limed plots were better than those from the controls at twenty-one of the twenty-three centres, the average difference in favour of the dressing of freshly-burned lime being 2½ cwt. per acre. Plots dressed with superphosphate and kainit gave higher yields than the controls at all centres at which the treatments were compared, the average increase being 4¼ cwt. per acre. Where sulphate of ammonia was used in addition to superphosphate and kainit, yields were better than from the controls at nine of the eleven centres, the average increase over the controls in this case being 4¾ cwt. per acre. The plots manured with superphosphate and kainit outyielded the limed plots at eleven of thirteen centres where the treatments were compared, the average increase in the yield of grain in favour of the former treatment being 2 cwt. per acre. At eleven centres where sulphate of ammonia was used in addition to superphosphate and kainit, the average

increase was 3 cwt. per acre over the plots which received a dressing of freshly-burned lime. Particulars of the yields of grain obtained in this series are given in Table III.

Series No. II.—Trials on lea wheat were conducted at sixteen centres in fourteen counties. Germination of the seed was good at all centres, and plant establishment was, on the whole, fairly satisfactory. The limed plots had a somewhat more forward appearance during the growing season than the controls but were not quite as good as those dressed with artificial manures. No lodging occurred at any centre and no serious attacks by insect pests or diseases were reported. A slight attack of wireworm occurred at one centre and birds did considerable damage to the ripening crop at another centre. Slight mildew attack was observed at one centre and slight rust at two centres. There was no difference between the times of ripening of the plots at any centre and the grain and straw produced were generally of excellent quality.

The limed plots gave heavier yields than the controls at twelve of the sixteen centres, the average increase due to the dressing of lime applied being ¾ cwt. per acre. Those dressed with superphosphate and kainit outyielded the control plots at all the centres at which the treatments were compared, the average increase in the yield of grain of the former plots being 3½ cwt. per acre. Where sulphate of ammonia was used in addition, the average increase over the contról plots was 3¼ cwt. per acre. Plots treated with superphosphate and kainit were compared with limed plots at eight centres. In seven cases the former outyielded the latter, the average increase in favour of the former being 2 cwt. per acre. Where sulphate of ammonia was used in addition to superphosphate and kainit (ten centres) the average increase over the limed plots was 2¾ cwt. per acre.

Particulars of the yields of grain obtained in Series II are given in Table IV.

These results further confirm those obtained in previous trials and indicate (*a*) that considerable increases in yields of grain can be obtained from applications of suitable mixtures of artificial manures to winter wheat and that on the poorer types of soil very substantial increases can be secured by such treatment, and (*b*) that in general, higher yields of winter wheat may be expected, particularly on the heavier types of soil, when a dressing of freshly-burned lime is applied to the crop.

WHEAT RIPENING TRIALS.

Wheat ripening trials similar to those conducted in 1937 and 1938 were repeated in the 1939 season. The object of these experiments was to ascertain the latest date on which varieties of wheat may be sown to ensure normal

ripening. The trials were laid down at 29 centres in 21 counties. Six varieties were included in the trials— five spring varieties and one winter variety.

The following table gives a summary of the number of centres at which each variety was sown and the total number of sowings of each variety.

Variety	No. of Centres	No. of Sowings
Squarehead Master	24	98
Red Marvel	29	130
Aurore	8	32
Atle	17	81
April Bearded Red	28	127
Diamant	19	82

Squarehead Master.

Four sowings of Squarehead Master were made in February. All ripened satisfactorily. Fifty-nine sowings were made from 1st to 30th March. All plots sown up to the middle of March ripened satisfactorily. Four sowings made from the middle to the end of the month failed to ripen. Thirty-five sowings were made between April 1st and 25th. Of these, twenty-seven failed to ripen. The sowings of the eight crops which ripened satisfactorily were made during the first week in April.

Red Marvel.

Four sowings of Red Marvel made in February and sixty-three made in March all ripened satisfactorily. Of fifty-six crops sown in April nine failed to ripen. The dates of sowing of the latter varied from the 4th to the 25th of the month. Of seven sowings made in May six failed to ripen.

Aurore.

Thirty-two sowings of this variety were made between February 23rd and May 11th. With the exception of two crops, one sown on May 2nd and the other on May 11th, all sowings ripened satisfactorily.

Atle.

All sowings of Atle made up to May 1st reached maturity. Two sowings made on May 2nd and 11th failed to ripen.

April Bearded Red.

One hundred and twenty-three sowings of April Bearded Red made between February 23rd and May 1st and two sowings made on May 2nd

ripened satisfactorily. Two sowings made on May 2nd and one on May 11th failed to ripen.

Diamant.

Seventy-eight sowings of Diamant made up to May 1st and two sowings made on May 2nd ripened. One sowing made on May 2nd and one on May 11th did not ripen.

The results of these trials are set out in detail in Table V.

TRIALS WITH VARIETIES OF WHITE OATS.

The varieties Victory II and Ardri were included in these trials which were conducted at sixty-six centres in 25 counties. Seeding took place from the middle of February to the middle of April. Germination was on the whole satisfactory and in a few cases Ardri showed somewhat more vigour than Victory II in this respect. Harsh, dry weather following brairding seriously retarded growth at all centres. A rapid recovery followed the change in weather conditions which set in towards the end of June and progress was satisfactory during the remainder of the season. The crops on the whole were fairly free from insect pests and diseases. Slight attacks of wireworms were reported from three centres. Severe attacks of leaf-stripe occurred at two centres while at five other centres slight attacks were observed. On the whole very little lodging was reported. Victory II lodged rather badly at two centres and slightly at six centres. In the case of Ardri slight lodging occurred at two centres. There was no difference in the times of ripening of the varieties at forty-nine centres. Ardri ripened two to three days later than Victory II at thirteen centres while at two centres Victory II ripened two to three days later than Ardri. At two other centres uneven ripening was reported. The grain produced was on the whole of good quality, Ardri being considered to be a little in advance of Victory II in this respect. Straw from both varieties was short and of satisfactory quality.

Particulars of the yields of grain obtained at each centre and of the average yields for 66 centres are given in Table VI. It will be observed from the results set out in the Table that Ardri outyielded Victory II at 47 of the 66 centres, the difference between the average yields in favour of Ardri being $1\frac{3}{4}$ cwt. per statute acre.

ripened satisfactorily. Two sowings made on May 2nd and one on May 11th failed to ripen.

Diamant.

Seventy-eight sowings of Diamant made up to May 1st and two sowings made on May 2nd ripened. One sowing made on May 2nd and one on May 11th did not ripen.

The results of these trials are set out in detail in Table V.

TRIALS WITH VARIETIES OF WHITE OATS.

The varieties Victory II and Ardri were included in these trials which were conducted at sixty-six centres in 25 counties. Seeding took place from the middle of February to the middle of April. Germination was on the whole satisfactory and in a few cases Ardri showed somewhat more vigour than Victory II in this respect. Harsh, dry weather following brairding seriously retarded growth at all centres. A rapid recovery followed the change in weather conditions which set in towards the end of June and progress was satisfactory during the remainder of the season. The crops on the whole were fairly free from insect pests and diseases. Slight attacks of wireworms were reported from three centres. Severe attacks of leaf-stripe occurred at two centres while at five other centres slight attacks were observed. On the whole very little lodging was reported. Victory II lodged rather badly at two centres and slightly at six centres. In the case of Ardri slight lodging occurred at two centres. There was no difference in the times of ripening of the varieties at forty-nine centres. Ardri ripened two to three days later than Victory II at thirteen centres while at two centres Victory II ripened two to three days later than Ardri. At two other centres uneven ripening was reported. The grain produced was on the whole of good quality, Ardri being considered to be a little in advance of Victory II in this respect. Straw from both varieties was short and of satisfactory quality.

Particulars of the yields of grain obtained at each centre and of the average yields for 66 centres are given in Table VI. It will be observed from the results set out in the Table that Ardri outyielded Victory II at 47 of the 66 centres, the difference between the average yields in favour of Ardri being $1\frac{3}{4}$ cwt. per statute acre.

Small Scale Winter Wheat Variety Trials, 1938–1939.

County	Nature of Soil	Date of Sowing	Manuring per Statute Acre	Previous Crop	Yield of Grain per Statute Acre									
					Queen Wilhelmina (ex Holland)		Queen Wilhelmina (local)		Pajbjerg		Juliana		Holdfast	
					c.	q.	c.	q.	c.	q.	c.	q.	c.	q.
Carlow	Medium Granitic Loam	22nd November	2 cwt Superphosphate 2 cwt. Kainit 1 cwt Sulphate of Ammonia	Pasture	19	0	19	1	19	2	20	1	12	2
Cavan	Clay Loam	4th do	1 cwt Nitrate of Soda	Potatoes	13	2	10	3	14	3	18	1	11	2
Clare (E.)	Heavy Limestone Loam	9th do	3 cwt Potassic Superphosphate	do	27	0	23	0	25	3	28	2	21	2
do.	Heavy Loam	2nd February	None	do	15	0	11	2	15	3	15	0	18	0
Clare (W.)	do	9th do	do	Sugar Beet	23	3	17	0	20	2	23	1	17	3
do	Average Loam	3rd do	4 cwt Superphosphate 1 cwt Sulphate of Ammonia	Potatoes	20	0	17	3	17	1	18	0	17	0
Cork (W.)	Medium Heavy Loam	30th January	None	Potatoes & Mangolds	33	3	35	0	35	2	37	1	28	0
do.	Medium Loam	28th do	do	Sugar Beet	29	0	31	2	31	3	25	3	24	0
Cork (S.E.)	Medium Sandstone Loam	28th do	1 cwt Sulphate of Ammonia 3 cwt Superphosphate 2 cwt Kainit 4 cwt. per acre	Potatoes	24	3	25	2	23	3	26	0	21	0
Do.	Gravelly Limestone Loam	3rd November	3 cwt Superphosphate 2 cwt Kainit 1 cwt Sulphate of Ammonia 5 cwt per acre	Pasture	30	1	30	3	34	2	29	1	27	2
Cork (Mid.)	Heavy Loam	2nd January	Complete dressing	do	31	3	31	3	37	2	35	1	26	3
Do	Medium Loam	28th do.	1 cwt Nitrate of Soda	Sugar Beet	22	1	20	1	21	0	19	3	12	2
Cork (N.)	do.	6th February	15 tons of Farmyard Manure	Wheat	25	3	27	3	33	2	15	0	18	1
Do.	Heavy Loam	2nd do	None	Potatoes	23	0	19	2	21	0	27	3	14	0
Cork (N.E.)	do	2nd do	do	do	35	0	29	2	36	2	33	1	22	0
Do.	Sandstone Loam	1st do	4 cwt Superphosphate	Wheat	22	2	18	3	20	2	21	2	20	3
Donegal	Bright Clay Loam	6th do	2 cwt Superphosphate 2 cwt Kainit 1 cwt Sulphate of Ammonia	Pasture	28	0	29	0	33	2	30	2	24	1
Do.	Dark Medium Loam	3rd do	3 cwt Superphosphate 1 cwt Kainit 1 cwt Sulphate of Ammonia	Potatoes	18	2	17	0	17	3	17	1	10	1
Dublin	Clay Loam	4th November	None	do.	22	2	22	0	23	2	22	0	16	1
Galway (N.)	Limestone Gravelly Loam	24th February	do	Wheat	18	2	18	0	17	1	17	0	16	2
Galway (S.)	Medium Limestone Loam	3rd do	1 cwt Sulphate of Ammonia	Sugar Beet	33	0	34	0	32	0	31	2	31	2
Kerry (N.)	Gravelly Loam	16th do.	None	Potatoes	20	0	15	0	20	3	21	0	18	0
Kildare	Medium Loam	6th December	do	Turnips and Oats	20	1	23	0	21	2	22	0	14	2
Do.	Heavy Loam	6th February	do	Sugar Beet	26	2	27	1	28	2	27	0	19	0
Kilkenny	Clay Loam	3rd do	do	Potatoes	18	0	23	0	20	2	21	2	17	0
Laoighis	Good Average Loam	7th November	6 cwt Potassic Superphosphate 1 cwt Sulphate of Ammonia	Hay	24	2	22	0	24	2	17	2	19	0
Do.	Light Clay Loam	12th February	Complete dressing	Potatoes and Wheat	21	3	22	3	19	0	20	1	18	3
Limerick (W.)	Heavy Limestone Loam	3rd do	None	Sugar Beet	17	0	18	3	16	2	19	2	18	1
Limerick (E.)	Clay Loam	18th do	do	do	28	0	28	0	30	0	26	3	30	0
Do.	do.	21st November	4 cwt Slag 1 cwt Sulphate of Ammonia	Potatoes	32	0	32	0	33	0	31	2	30	0
Longford	Strong Loam	3rd February	None	do.	27	1	24	0	25	3	26	3	22	2

TABLE II.

Spring Wheat Variety Trials. 1939.

County	Nature of Soil	Previous Crop	Manuring per Statute Acre	Date of Sowing	Yield of Grain per Statute Acre: Red Marvel	Atle	April Bearded Red	Aurore	Diamant II
					c. q.	c. q.	c. q.	c. q.	c. q.
Carlow	Good Granitic Loam	Potatoes	None	16th March	15 1	16 3	18 2	15 0	12 0
Cavan	Good Clay Loam	do	do	3rd April	12 1	17 2	20 2	13 1	22 1
Do	Good Loam	do	do	14th March	15 3	18 0	20 0	16 0	17 0
Clare (E.)	Medium Loam	Sugar Beet	do	14th do	24 1	23 2	23 2	23 0	21 2
Do	Deep Loam	Potatoes	do	16th do	17 0	16 2	23 0	21 1	21 1
Clare (W.)	Good Deep Loam	do	do	20th do	20 3	13 3	17 1	12 1	13 3
Do	Average Loam	Mangolds	do	31st do	17 0	12 1	15 0	10 3	14 1
Cork (W.)	Light Loam	Potatoes	3 cwt. Superphosphate 2 cwt. Kainit 1 cwt. Sulphate of Ammonia applied at the rate of 3 cwt. per statute acre	20th do.	11 1	5 0	22 1	22 0	17 3
Do	Medium Loam	Roots	2 cwt. Superphosphate	21st do	22 2	19 0	20 1	15 3	18 1
Cork (Mid.)	do	Potatoes	None	13th do.	22 3	21 0	21 0	19 2	21 3
Do	do	Sugar Beet	1 cwt. Nitrate of Soda	14th do	22 2	25 0	23 3	21 3	24 0
Cork (S.E.)	Light Gravelly Loam	Root Crops	None	24th do	6 3	13 2	14 3	13 1	16 3
Do	Medium Sandstone Loam	Pasture	4 cwt. Superphosphate 2 cwt. Kainit 1 cwt. Sulphate of Ammonia applied at the rate of 5 cwt. per acre	10th do	23 0	23 2	25 3	23 0	26 2
Cork (N.)	Medium Loam	Mangolds	None	14th do	12 3	13 0	13 3	8 3	15 0
Dublin	Loam	Potatoes	do	21st do	18 2	19 3	17 3	16 1	18 0
Do	Clay Loam	Mangolds	do	8th April	15 2	24 0	18 1	12 2	22 2
Galway (N.)	do	Potatoes	do	14th March	16 2	18 0	18 1	20 1	20 0
Do	do	do	do	16th do	16 1	17 2	16 1	16 0	17 0
Kerry (N.)	Light Peaty Loam	do	do	29th do	9 1	14 3	9 3	13 3	18 1
Do.	Light Loam	do	do	30th do	12 1	15 3	19 1	18 1	20 3
Kildare	Medium Loam	Turnips	do	16th do	23 2	26 0	24 2	20 2	26 3
Kilkenny	Old Red Sandstone Loam	Old Pasture	4 cwt. Potassic Superphosphate 1 cwt. Sulphate of Ammonia	13th do.	13 0	27 1	24 2	25 0	23 0
Do	Medium Old Red Sandstone	Sugar Beet	None	15th do	12 2	15 1	17 1	15 0	17 2
Laoighis	Heavy Loam	do	do	23rd do.	15 0	17 3	17 0	17 3	16 1
Do	Moory Loam	Pasture	5 cwt. Potassic Superphosphate	22nd do	14 3	16 3	19 1	16 0	16 1
Leitrim	Clay Loam	Potatoes	None	20th do	21 1	19 2	23 0	16 3	21 0
Limerick (W.)	Sandstone Loam	Sugar Beet	do	28th do.	12 2	20 0	18 0	20 2	19 0
Do	Limestone Loam	do	do	21st do.	22 3	26 1	24 2	23 2	19 2
Limerick (E.)	Clay Loam	do.	do.	15th do	22 3	20 2	22 3	23 0	23 2
Do.	Light Limestone	do	do.	28th do.	26 0	25 0	26 0	25 0	24 0
Longford	Loam	Potatoes	do.	30th do.	28 0	26 3	28 0	21 0	27 1
Do	Stiff Loam	do	1 cwt. Sulphate of Ammonia	27th do.	19 0	18 0	19 2	15 3	17 1
Louth	Gravelly Loam	Roots	1 cwt. Sulphate of Ammonia 2 cwt. Kainit 3 cwt. Superphosphate	28th do.	20 0	25 2	20 0	21 2	23 2
Do.	Loam	Potatoes	3 cwt. Superphosphate 2 cwt. Kainit	6th do.	20 0	23 0	19 2	16 0	16 3
Mayo (S.)	Rich Clay Loam	Sugar Beet	None	26th do.	21 0	20 0	22 0	20 3	21 0

TABLE V.

Ripening Trials with Varieties of Wheat Sown on Different Dates in 1939.

County	Nature of Soil	Date of Sowing	Date of Ripening: Squarehead Master	Red Marvel	Aurore	Atle	April Bearded Red	Diamant
CAVAN	Clay Loam	1st March	5th September	5th September	20th August	31st August	23rd August	23rd August
		7th do	5th do	5th do.	20th do	31st do	23rd do	23rd do.
		13th do	9th do	9th do	23rd do	31st do	23rd do	26th do.
		20th do	9th do	9th do	23rd do	9th September	23rd do.	26th do
		29th do.	11th do	9th do	26th do	9th do	31st do.	31st do.
		8th April	27th do	11th do	26th do	11th do	31st do.	9th September
CLARE (W.)	Average Loam	15th March	4th September	30th August	—	—	5th August	—
		26th do.	9th do.	17th September	—	—	12th do	—
		4th April	20th do	27th do	—	—	17th do.	—
		12th do	Did not ripen	Did not ripen	—	—	24th do	—
CORK (Mid.)	Heavy Loam	10th March	8th September	4th September	—	—	18th August	18th August
		20th do	11th do	8th do	—	—	23rd do	23rd do.
		3rd April	18th do	11th do	—	—	29th do.	23rd do.
		17th do	Did not ripen	11th do	—	—	8th September	8th September
		28th do	—	—	—	—	11th do.	11th do.
CORK (S.E.)	Light Gravelly Loam	13th March	4th September	24th August	—	19th August	17th August	16th August
		24th do.	Did not ripen	29th do.	—	24th do	23rd do	22nd do.
		5th April	do	4th September	—	28th do	26th do	26th do.
		14th do	do	12th do.	—	2nd September	29th do	29th do.
CORK (S.E.)	Gravelly Sandstone Loam	7th March	28th August	14th August	—	10th August	8th August	7th August
		23rd do	9th September	21st do	—	15th do	14th do	13th do.
		4th April	Did not ripen	1st September	—	21st do	17th do	16th do.
		14th do	do	10th do	—	26th do	23rd do	21st do.
CORK (N.)	Medium Loam	3rd March	6th September	24th August	—	—	20th August	—
		15th do	9th do	30th do	—	—	20th do	—
		1st April	Did not ripen	4th September	—	—	27th do	—
CORK (N.E.)	Light Sandstone Loam	6th March	4th September	28th August	—	21st August	18th August	15th August
		16th do	14th do	3rd September	—	25th do.	22nd do	22nd do.
		28th do	22nd do	11th do	—	30th do	26th do	26th do.
		11th April	Did not ripen	20th do	—	10th September	3rd September	3rd September
DUBLIN	Loam	16th March	Did not ripen	2nd September	22nd August	30th August	30th August	26th August
		24th do.	—	5th do	30th do	1st September	30th do	30th do
		31st do.	—	12th do	30th do	5th do.	2nd September	30th do.
KERRY (N.)	Light Loam	8th March	31st August	23rd August	—	—	—	—
		20th do	9th September	26th do	—	—	14th August	—
		30th do	20th do.	28th do	—	—	17th do.	—
		8th April	Did not ripen	30th do	—	—	23rd do	—
		18th do.	—	—	—	—	28th do.	—
		28th do.	—	—	—	—	31st do.	—
[illegible]	[illegible]	[illegible]	[illegible]	16th August	—	—	—	—

TABLE VI.

Oat Variety Trials, 1939.

County	Nature of Soil	Yield per Statute Acre (Grain) Victory II cwt	qr	Ardri cwt	qr
Carlow	Granitic Loam	22	3	23	1
Cavan	Clay Loam	9	1	12	2
Cavan	Medium Loam	11	1	14	3
Clare (E.)	Clay Loam	17	0	18	2
Clare (E.)	Light Gravelly Loam	20	0	24	1
Clare (W.)	Heavy Loam	19	1	21	3
Clare (W.)	Medium Loam	12	1	17	1
Cork (Mid.)	Medium Loam	21	3	28	0
Cork (N.)	Heavy Loam	21	1	17	0
Cork (N.)	Medium Loam	11	2	14	2
Cork (N.E.)	Limestone Loam	25	3	20	0
Cork (N.E.)	Light Limestone Loam	21	1	21	0
Cork (S.E.)	Medium Sandstone Loam	11	1	13	3
Cork (S.E.)	Medium Loam	7	3	18	1
Cork (W.)	Light Loam	22	1	26	3
Cork (W.)	Light Loam	15	3	18	1
Dublin	Sharp Loam	19	1	19	1
Dublin	Heavy Clay	19	3	18	2
Galway (N.)	Clay Loam	19	1	21	0
Galway (N.)	Light Limestone Loam	23	2	21	3
Kerry (N.)	Light Loam	21	3	21	2
Kerry (N.)	Strong Loam	31	3	34	2
Kildare	Heavy Clay	24	3	23	1
Kildare	Grey Moor	19	2	18	3
Kilkenny	Good Limestone Drift	15	3	21	0
Laoighis	Clay Loam	11	0	12	2
Laoighis	Strong Loam	22	3	26	1
Leitrim	Clay Loam	22	2	20	0
Leitrim	Clay Loam	24	2	22	2
Limerick (E.)	Rich Loam	30	0	32	0
Limerick (E.)	Loam	28	2	30	0
Limerick (W.)	Sandstone Loam	27	2	29	0
Limerick (W.)	Limestone Loam	29	2	30	2
Longford	Light Loam	20	0	19	1
Longford	Stiff Loam	17	2	20	0
Louth	Loam	34	2	33	2
Louth	Heavy Loam	15	3	14	2
Mayo (S.)	Good Loam	9	0	16	3
Mayo (S.)	Heavy Clay	21	0	22	3
Mayo (N.)	Deep Loam	26	0	28	2
Mayo (N.)	Medium Loam	26	2	24	0
Meath (N.)	Light Gravelly Soil	23	1	18	2
Meath (N.)	Heavy Loam	14	2	19	0
Meath (S.)	Clay Loam	23	3	27	2
Monaghan	Loam	11	2	16	0
Offaly	Heavy Loam	27	1	27	3
Offaly	Medium Loam	14	0	13	1
Roscommon (S.)	Medium Loam	23	2	27	0
Roscommon (S.)	Light Medium Loam	24	1	22	0
Roscommon (N.)	Medium Loam	19	0	25	0
Roscommon (N.)	Light Loam	16	2	20	2
Sligo	Deep Loam	23	2	24	1
Sligo	Deep Loam	21	0	22	0
Tipperary (N.R.)	Strong Clay	18	2	20	0
Tipperary (S.R.)	Medium Clay on Limestone	20	0	21	0
Tipperary (S.R.)	Medium Clay on Limestone	22	0	23	0
Tipperary (S.R.)	Medium Loam	22	2	24	3
Tipperary (S.R.)	Deep Rich Loam	24	1	28	3
Waterford	Medium Loam	19	2	24	2
Waterford	Medium Loam	27	2	26	1
Westmeath	Heavy Friable Loam	17	2	21	0
Westmeath	Heavy Limestone Loam	28	2	32	2
Wexford	Medium Clay Loam	17	1	20	3
Wexford	Light Clay Loam	19	1	21	0
Wicklow	Medium Loam	17	1	17	3
Wicklow	Dark Loam	20	1	19	3
	Average Yield (66 Centres)	20	2	22	1

TRIALS WITH GRASS AND CLOVER SEED MIXTURES.

These trials, which were commenced in 1936, consist of two series :--

Series No. 1. Laid down on land of average to good quality.

Series No. 2. Laid down on poor, non-peaty soils.

The object of the trials is to test a somewhat simpler mixture and lighter seeding of grass and clover seeds than that set out in the Department's Leaflet No. 42 "The Laying Down of Land to Hay and Pasture."

Series No. 1.

In this series trials were laid down in 1936 at thirty-five centres in twenty counties. The mixtures used were as follows :

Mixture I.

15 lb. Perennial Ryegrass
7 ,, Italian Ryegrass.
4 ,, Meadow Fescue.
3 ,, Timothy.
3 ,, Cocksfoot.
4 ,, Broad Red Clover.
2 ,, Alsike Clover.
½ ,, Kentish Wild White Clover.

Mixture II.

14 lb. Perennial Ryegrass
8 ,, Cocksfoot.
4 ,, Timothy.
2 ,, Rough stalked Meadow Grass.
4 ,, Late flowering Red Clover (Single cut Cow-Grass).
½ ,, Kentish Wild White Clover.

The plots were meadowed in 1937. In the 1938 season they were again meadowed at 28 centres and grazed at 7 centres. Reports on the plots for these two years were published in Volume XXXV No. 2 and Volume XXXVI No. 1, respectively, of the Journal of the Department of Agriculture.

In the 1939 season the plots were meadowed at 15 centres and grazed at 19 centres.

Meadowed Plots. In early spring the plots sown with Mixture II had a closer and denser appearance than those sown with Mixture I at six centres, while at nine centres no difference was observed during this period. Weeds and useless grasses were somewhat less prevalent on the plots seeded with Mixture II, although the difference between the plots in this respect was not very marked.

The higher yields of hay were obtained from Mixture II at eight centres and from Mixture I at five centres. The average yield from the former exceeded that of the latter by one cwt. per acre. Particulars of the yields are given in Table VII.

TABLE VII.

Trials with Grass and Clover Seed Mixtures on land of average to good quality (laid down in 1936).

County	Yield per Statute Acre.			
	Mixture I		Mixture II	
	cwt.	qr.	cwt.	qr.
Carlow	37	2	40	3
Cavan	22	0	24	0
Clare (W.)	54	0	51	0
Cork (W.)	41	0	41	0
Dublin	75	0	78	3
Limerick (E.)	37	3	42	1
Mayo (S.)	26	0	28	0
Offaly	16	0	20	0
Roscommon (N.)	30	0	28	0
Roscommon (S.)	31	0	28	0
Sligo	28	0	28	0
Tipperary (N.R.)	33	0	31	0
Westmeath	30	0	28	0
Wicklow	38	2	44	1
Wicklow	29	2	31	3
Average Yield (15 Centres) ..	35	1	36	1

Aftergrass from Mixture II was better at five centres, while at nine centres no difference in this respect was observed. Meadow Fescue did not become established on Mixture I plots at any centre. Cocksfoot gave better establishment on Mixture II plots, while the clovers appeared to be present on both plots in about equal amount.

Grazed Plots. During the early spring months growth was backward and little difference could be observed between the plots at 14 centres. Mixture II had the better appearance at three centres and Mixture I at two centres. On the whole few weeds were present in the pastures at any centre and there was little to choose between the plots in this respect.

Satisfactory grazing results were on the whole provided by both mixtures.

In general, red and white clovers were well established on both plots and gave well-balanced palatable pastures. At a few centres there was a slight tendency to coarseness in the herbage due to a profuse growth of cocksfoot. Taking the grazing season as a whole, Mixture II gave the more satisfactory grazing results at five centres while at thirteen centres equal results were obtained.

Series No. 2.

The trials in this series were laid down in 1936 at thirty centres in twenty counties on poor, non-peaty soils. The mixtures used were as follows :—

Mixture No. 1.

15 lb. Perennial Ryegrass.
7 ,, Italian Ryegrass.
4 ,, Meadow Fescue.
3 ,, Timothy.
3 ,, Cocksfoot.
4 ,, Broad Red Clover
2 ,, Alsike Clover.
½ ,, Kentish Wild White Clover.

Mixture No. 2.

21 lb. Perennial Ryegrass.
2 ,, Crested Dogstail.
2 ,, Rough-stalked Meadow Grass.
3 ,, Late-flowering Red Clover (Single-cut Cow-grass.
½ ,, Kentish Wild White Clover.

The plots were meadowed in the 1937 season at all centres. In 1938 they were meadowed at 21 centres and grazed at 9 centres. Reports on the plots for these two years were published in Volume XXXV No. 2 and Volume XXXVI No. 1, respectively, of the Journal of the Department of Agriculture.

In the 1939 season the plots were meadowed at 14 centres and grazed at 16 centres.

Meadowed Plots. The general appearance of the plots during the spring months was, on the whole, satisfactory. With the exception of meadow fescue, sown species had persisted and in most cases gave promise of a good mixed herbage, which included a fair proportion of red and white clovers. The plots were relatively free from weeds and, in general, there was little difference in their appearance during the early spring and summer months.

Heavier yields of hay were obtained from Mixture II at 5 centres and from Mixture I at seven centres. The average yield of hay, particulars of which are given in Table VIII, from Mixture I was higher than from Mixture II by over 2 cwt. per acre.

TABLE VIII.

Trials with Grass and Clover Seed Mixtures on poor Non-peaty Soils (laid down in 1936).

County	Yield per Statute Acre			
	Mixture I		Mixture II	
	cwt.	qr.	cwt.	qr.
Cavan	24	0	28	0
Clare (E.)	38	0	33	0
Cork (W.)	41	3	34	1
Dublin	33	2	37	0
Kildare	33	1	29	3
Laoighis	21	0	24	0
Mayo (S.)	24	0	25	0
Offaly	42	0	34	0
Sligo	31	0	31	0
Tipperary (N.R.)	24	0	24	0
Westmeath	38	3	29	2
Wexford	40	0	31	0
Wicklow	34	1	34	3
Wicklow	35	2	34	2
Average Yield (14 Centres) ..	33	0	30	3

The bulk and palatability of the aftergrass was generally satisfactory. All sown species, except meadow fescue, were well represented in the grazing. The aftergrass from Mixture II made somewhat slower growth than that from Mixture I but, on the whole, the former gave a satisfactory though a shorter type of pasture. Mixture II gave the better aftergrass at 8 centres and Mixture I at 4 centres. The results were equal at the remaining centres.

Grazed Plots. In spring, Mixture II was regarded as being earlier than Mixture I in four cases, while the latter had an earlier appearance at 4 other centres. In the remaining cases no outstanding difference was observed between the plots during the spring months. Sown species were, on the whole, well represented and the plots were fairly free from weeds and worthless grasses. There was no outstanding difference between the mixtures in this respect.

The pasture produced from both mixtures was satisfactory. Mixture II produced a lower and more dense type of herbage, while that produced from Mixture I was in some cases regarded as being more suitable for the production of hay than of pasture. Grazing results were superior from Mixture II at 5 centres and from Mixture I at 5 different centres, while similar results were obtained at the remaining centres.

TRIALS WITH GRASS AND CLOVER SEED MIXTURES, LAID DOWN IN 1937.

Trials similar to those laid down in 1936 were also laid down at 38 centres in the spring of 1937.—Series No. 1: On land of average to good quality and Series No. 2: On poor non-peaty soils. The mixtures used in each series were identical with those used in the respective series in 1936, particulars of which are given on a preceding page. The plots in each series were meadowed in 1938 and particulars of the yields of hay obtained and of the appearance of the plots throughout the season were published in Volume XXXVI No. 1 of the Journal of the Department of Agriculture.

Series No. 1.

In 1939 the plots in this series were meadowed at 19 centres and grazed at 11 centres. Owing to changes in management of the plots due to unfavourable weather conditions in spring and early summer, returns from the remaining centres were not available.

Meadowed Plots. Mixture II did not appear generally to be quite so early in spring as Mixture I but it produced a closer and denser sward than the latter. The former mixture was regarded as being superior during this period at 6 centres and the latter at 3 centres, while at 12 centres the appearance of the plots was somewhat similar. All sown species were fairly well represented in the swards and the plots were in general remarkably free from weeds and worthless grasses.

Particulars of the yields of hay obtained are given in Table IX. It will be observed that the average yields were practically equal.

TABLE IX.

Trials with Grass and Clover Seed Mixtures on land of average to good quality (laid down in 1937).

County	Yield per Statute Acre			
	Mixture I		Mixture II	
	cwt.	qr.	cwt.	qr.
Carlow	40	0	40	0
Cavan	16	0	12	0
Clare (W.)	25	0	24	2
Cork (N.)	46	0	69	0
Galway (S.)	22	0	20	0
Kildare	39	2	43	3
Kilkenny	39	0	43	0
Laoighis	31	0	33	0
Limerick (E.)	44	0	43	1
Mayo (S.)	30	0	32	0
Meath (S.)	28	1	26	3
Monaghan	28	2	26	0
Roscommon (S.)	35	0	31	0
Tipperary (N.R.)	31	0	28	0
Tipperary (S.R.)	35	0	35	0
Tipperary (S.R.)	32	0	30	0
Tipperary (S.R.)	28	0	28	0
Westmeath	40	0	30	0
Wicklow	39	0	37	3
Average Yield (19 Centres)	33	0	33	1

The yields of aftergrass were satisfactory at all centres. Mixture II gave a denser type of sward at 6 centres. At the remaining centres the crops of aftergrass were rather similar. All sown species were well represented in the swards, the amount of Red Clover in both plots at the different centres being almost equal.

Grazed Plots. As in the case of the meadowed plots, Mixture II gave a somewhat closer sole than Mixture I at most centres. On the whole, however, there was not much to choose between the mixtures in this respect. The establishment and survival of sown species were generally regarded as satisfactory. Weeds and worthless grasses were not present to a marked extent at any centre.

Throughout the grazing season Mixture II plots had a denser appearance and contained a better mixture of grasses and clovers than the Mixture I plots. The former also showed better establishment of sown species and appeared to stand up to hard grazing better than the latter.

Taking the grazing season as a whole, Mixture II gave the better results at 5 of the 11 centres at which the plots were grazed in 1939. At 5 other centres the grazing results were somewhat similar.

Series No. 2.

In 1939 the plots in this series were meadowed at 18 centres and grazed at 10 centres.

Meadowed Plots. The plots laid down with Mixture I had a more promising appearance in spring at 7 centres. Mixture II gave better promise at 4 centres, while the pastures presented a similar appearance at the remaining centres. The sown species, noticeably the clovers and ryegrasses were well represented and weeds were not prevalent at any centre. Crested dogstail and rough-stalked meadow grass produced a short, close sward on Mixture II plots. Mixture I produced the heaviest yield of hay at 9 centres and Mixture II at 6 centres. Particulars of the yields of hay obtained are given in Table X.

TABLE X.

Trials with Grass and Clover Seed Mixtures on poor Non-peaty Soils (laid down in 1937).

County	Yield per Statute Acre: Mixture I cwt.	Mixture I qr.	Yield per Statute Acre: Mixture II cwt.	Mixture II qr.
Clare (E.)	40	0	36	0
Clare (W.)	48	0	46	0
Cork (Mid.)	40	0	40	0
Cork (N.E.)	62	0	57	0
Cork (N.)	39	3	43	2
Dublin	32	1	26	3
Kerry (N.)	35	3	39	0
Kildare	31	3	33	0
Limerick (E.)	48	1	46	1
Mayo (S.)	20	0	20	0
Mayo (S.)	30	0	28	0
Meath (N.)	35	0	31	0
Roscommon (N.)	30	0	30	0
Sligo	34	0	36	0
Tipperary (N.R.)	32	0	29	0
Westmeath	30	0	24	0
Wicklow	24	0	27	2
Average Yield (17 centres) ..	36	0	34	3

The aftergrass on Mixture I plots made somewhat more rapid growth than that on Mixture II plots but, on the whole, it presented a more open appearance. The latter was closer and shorter and had more of the characteristics of an established pasture. Red and white clover were present in

fair amounts on both plots but the former species appeared to be represented in somewhat greater quantity on the plots seeded with Mixture II. The other sown species were well represented.

Grazed Plots. The plots seeded with Mixture I had a more promising appearance in spring and provided earlier and more abundant grazing at 5 centres. There was no appreciable difference between the mixtures at 4 centres, while at one centre Mixture II was considered to have the more satisfactory appearance. Weeds were not present to a great extent at any centre and were kept well in check by the rapid spread of clovers which were present in about equal amount on both plots. With the exception of meadow fescue all the sown species were well represented in the herbage. There was little to choose between the plots throughout the grazing season. Mixture I provided a more luxuriant pasture at 2 centres. The sward from Mixture II was the more dense at 2 centres while at the remaining centres the pastures were similar in appearance and about equal in grazing capacity.

TRIALS WITH GRASS AND CLOVER SEED MIXTURES LAID DOWN IN 1938.

Trials similar to those laid down in 1936 and 1937 were laid down in the 1938 season--Series No. 1 on land of average to good quality and Series No. 2 on poor non-peaty soils. The mixtures used were identical with those used in the 1936 and 1937 trials, particulars of which are given on a preceding page.

Series No. 1.

In this series trials were laid down at 43 centres in 26 counties. Except for slight injury caused by lodging of patches of the nurse crop, a satisfactory strike of seeds was obtained at all centres. Growth was somewhat retarded by harsh, dry weather in spring and early summer, but as the season advanced all plots made satisfactory progress. Mixture I had an earlier and more forward appearance at 19 centres and Mixture II at 7 centres. At 17 centres the plots had a similar appearance during the spring months.

The quality of hay produced was considered satisfactory but Mixture I was somewhat more satisfactory than Mixture II in this respect. Owing to shortage of grazing, weighings of hay were not taken at 2 centres. Mixture I gave the heavier yields of hay at 28 centres and Mixture II at 10 centres. Particulars of the yields obtained in this series are given in Table XI.

TABLE XI.

Trials with Grass and Clover Seed Mixtures on land of average to good quality (laid down in 1938).

County	Yield per Statute Acre			
	Mixture I		Mixture II	
	cwt.	qr.	cwt.	qr.
Carlow	38	1	37	2
Cavan	21	0	18	0
Clare (E.)	33	0	31	0
Clare (W.)	67	0	64	0
Cork (N.)	58	2	57	0
Cork (W.)	67	0	58	2
Cork (N.E.)	43	0	41	0
Cork (S.E.)	35	3	48	0
Cork (S.E.)	19	0	24	3
Cork (S.E.)	29	0	45	3
Cork (Mid.)	63	0	57	0
Donegal	28	1	26	0
Dublin	54	1	48	3
Galway (N.)	31	0	32	2
Kerry (N.)	64	1	59	3
Kildare	41	1	35	2
Laoighis	32	3	39	0
Leitrim	33	0	29	0
Limerick (W.)	60	0	60	0
Limerick (E.)	44	1	50	2
Longford	35	0	48	0
Louth	34	0	36	0
Mayo (S.)	26	0	25	0
Mayo (N.)	36	0	34	0
Meath (N.)	26	0	26	0
Meath (S.)	28	0	24	0
Meath (S.)	32	2	26	2
Monaghan	26	2	28	1
Offaly	36	0	30	0
Offaly	46	0	40	0
Roscommon (N.)	38	0	35	0
Roscommon (S.)	44	0	38	0
Sligo	37	0	36	0
Tipperary (N.R.)	22	0	19	0
Tipperary (S.R.)	25	0	25	0
Tipperary (S.R.)	24	0	22	0
Tipperary (S.R.)	26	0	23	2
Waterford	35	2	30	1
Westmeath	19	0	25	0
Wexford	48	0	44	0
Wicklow	45	2	49	0
Average Yield (41 Centres)	38	0	37	0

The aftergrass from Mixture I generally developed more quickly than that from Mixture II. This was attributed in part to the presence of Italian rye-grass in the former Mixture. Red and white clover were well represented in both plots at the majority of the centres and little difference could be observed between the seedings in this respect. In general, aftergrass was considered better from Mixture I at 14 centres, from Mixture II at 10 centres, while at 17 centres no difference was observed.

Series No. 2.

In this series trials were laid down at 38 centres in 26 counties. At one centre the seeds failed to germinate. At the remaining centres a good strike was obtained but in three cases some injury was caused by the lodging of the nurse crop. Growth was somewhat retarded by harsh, dry weather in the spring and early summer months.

The sown species were generally well represented in the herbage. Mixture I was considered to have the more forward appearance at 18 centres. This was attributed mainly to the presence of Italian rye-grass in the Mixture. Mixture II was better at 2 centres, while in the remaining cases no difference was observed in the bulkiness or density of the sward. Owing to scarcity of grass the plots were grazed throughout the season at 8 centres. The hay from both mixtures was of satisfactory quality, Mixture I being somewhat superior to Mixture II in this respect. Heavier yields of hay were obtained from Mixture I than from Mixture II at 22 centres, the average yield from the former being greater than that from the latter by two cwt. per acre. The yields obtained are set out in Table XII.

TABLE XII.

Trials with Grass and Clover Seed Mixtures on poor Non-peaty Soils (laid down in 1938).

County	Yield per Statute Acre			
	Mixture I		Mixture II	
	cwt.	qr.	cwt.	qr.
Carlow	32	1	31	2
Cavan	27	0	19	0
Clare (E.)	36	0	39	0
Cork (W.)	53	2	47	3
Cork (N.E.)	52	0	45	2
Cork (S.E.)	29	2	26	2
Donegal	30	1	26	3
Galway (N.)	29	0	26	2
Kerry (N.)	37	3	39	2
Kildare	37	2	32	3
Laoighis	26	3	27	2
Leitrim	36	0	33	2
Limerick (W.)	35	0	35	0
Limerick (E.)	40	0	38	0
Longford	26	0	30	0
Mayo (S.)	24	0	23	0
Mayo (N.)	37	0	33	0
Meath (N.)	26	0	33	0
Meath (S.)	25	2	22	3
Meath (S.)	26	2	23	0
Offaly	26	0	26	0
Offaly	51	0	45	0
Roscommon (N.)	32	0	31	0
Roscommon (S.)	38	0	31	0
Sligo	38	0	35	0
Tipperary (N.R.)	24	0	21	0
Tipperary (S.R.)	30	0	28	0
Waterford	34	0	28	0
Westmeath	20	0	24	0
Wexford	39	0	33	0
Average Yield (30 Centres)	33	1	31	0

Satisfactory crops of aftergrass and late grazing were obtained from each mixture at all centres. The sown species were well represented and there was relatively little difference in the bulk or quality of the produce at any centre. Red clover comprised a large bulk of the herbage in the case of both mixtures and rough-stalked meadow-grass was conspicuous on the Mixture II plots in some cases. At 16 centres Mixture 1 produced the better type of aftergrass. Mixture II gave better results at 7 centres while at the remaining centres no difference in the quality or bulk of the aftergrass was observed.

REPORT OF THE SEED PROPAGATION DIVISION, 1939.

As in previous years the bulk of the barley propagations and other investigational work was carried out at the Cereal Station, Ballinacurra, Co. Cork, in close collaboration with Messrs. A. Guinness, Son & Co. Ltd., at whose Experimental Maltings the malting tests were conducted. The work consisted of the usual pure line propagations, large scale variety, half drill strip and other experiments.

Pure line propagations of Black Tartary Oats were maintained at the Cereal Station and extension plots of Victory II and Ardri were grown in the neighbourhood of Ballinacurra.

WEATHER CONDITIONS.

The year commenced with a spell of very severe weather. The average temperature for January was 7.5° F below normal while the rainfall amounted to almost 5 inches. The weather during February was also very broken and tillage operations were impeded except on very light soils. A long period of dry weather set in in March which made possible the sowing of crops under good conditions. Growth during April and early May was checked by harsh winds and low temperature. The dry weather which commenced in March continued up to the end of June and the average rainfall for the four months, March to June inclusive, was only about half the normal amount. All crops were severely affected by the drought in May and June. The rainfall during July was heavy and greatly improved crop growth. Grain crops ripened early and in general were cut under ideal conditions. Warm damp weather during the first week in September rendered the saving of corn difficult. Subsequently, however, conditions improved and harvesting operations were completed without difficulty.

BARLEY.

The method adopted in 1929 for the selection of a pure line of Spratt-Archer 37 No. 3 was again employed. Ten grains were taken from every fifth plant in the single line and five grains from each of these lots of ten were sown as a single line this year, the other five grains being retained to replace any losses which might occur through damage by vermin or other causes.

Spratt-Archer 37 No. 4 was propagated in a similar manner.

The other 54 varieties or selections, which were propagated in single lines in the New Cage, were sown with seed taken from the bulk of the produce of the single line of last year. These were Spratt-Archer 37/6, Spratt-Archer 37 No. 3 (25 ears for experimental purposes), Spratt-Archer 37/9, Spratt-Archer 37/12/41, Spratt-Archer 37/6 No. 7. Spratt-Archer 37 No. 3 H9, Archer, Goldthorpe, Spratt, Old Irish, Burton Malting, Plumage-Archer, D.S.K. Binder, Victory, Kenia, Neils Franchen, Goldberg, Duck Bill, Glabron, Black Himalayan, Black Russian, Archer-Goldthorpe 4/5/1, Hybrid No. 1 C., Hybrid No. 4 A., Hybrid No. 4 B.1., Hybrid No. 7, Golden Archer 2, Golden Archer 1, Spratt-Archer 37 No. 4 x July Six-Rowed 16/2, Spratt-Archer 37 No. 3 x Victory 1, Spratt-Archer 37 No. 3 x Victory 2, Spratt-Archer 37 No. 3 x Victory 5, Hybrid 4 B.1 x Golden Archer 1, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 (Bulk), Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 1, Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2 No. 2, Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 (Bulk), Spratt-Archer 37 No. 3 x Hybrid 4 B.1 No. 1, Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 2, Spratt-Archer 37/9 x Golden Archer 2 (Bulk), Spratt-Archer 37/9 x Golden Archer 2 No. 1, Spratt-Archer 37/9 x Golden Archer 2 No. 2, Spratt-Archer 37/9 x Golden Archer 2 No. 3, Spratt-Archer x Glabron x Spratt-Archer 1, Spratt-Archer x Glabron x Spratt-Archer 2, Spratt-Archer x Glabron x Spratt-Archer 3, Pearl, Donegal Six-Rowed, July Six-Rowed, Beaven's F.112, Beaven's 49/14/3, B. 244, Naked, Chevallier (local).

The garden plots were grown in the Rosehill Cage Field and consisted of the following :—

Spratt-Archer 37/12/41.
Spratt-Archer 37 No. 3 (25 lines).
Spratt-Archer 37/6 No. 7.
Spratt-Archer 37 No. 3 H.9.
Spratt-Archer 37/9.
Archer.
Chevallier (Local).
D.S.K. Binder.
Kenia.
Maja.
Tschermack Brewing.
Golden Archer 2.
Spratt-Archer 37 No. 4 x July Six-Rowed 16/2.
Spratt-Archer 37 No. 3 x Victory 1.
Spratt-Archer 37 No. 3 x Victory 2
Spratt-Archer 37 No. 3 x Victory 5.

Hybrid 4 B. 1 x Golden Archer 1.

Spratt-Archer x Glabron x Spratt-Archer 1.

Spratt-Archer x Glabron x Spratt-Archer 2.

Spratt-Archer x Glabron x Spratt-Archer 3.

July Six-Rowed.

Field Plots, comprising the following varieties, were grown on the Ramhill South Farm :-

Spratt-Archer 37 No. 3.

Spratt-Archer 37 No. 3 H.9.

Spratt-Archer 37/6 No. 7.

Archer.

D.S.K. Binder.

Golden Archer 2.

Spratt-Archer 37 No. 4 x July Six-Rowed 16/2.

Spratt-Archer 37 No. 3 x Victory 5.

Spratt-Archer x Glabron x Spratt-Archer 1.

Spratt-Archer x Glabron x Spratt-Archer 2.

Spratt-Archer x Glabron x Spratt-Archer 3.

July Six-Rowed.

A portion of each of these plots was dressed with sulphate of ammonia at the time of sowing, at the rate of 1 cwt. per statute acre. Owing to the exceptionally dry period in the early part of the summer, the straw on all the plots was very short, and scarcely any difference could be observed between the treated and untreated portions.

First Pedigree Plots of the following varieties were grown on the Ramhill Farm of Messrs. J. H. Bennett Ltd., Ballinacurra :

Spratt-Archer 37 No. 3	4 acre.
Spratt-Archer 37 No. 3 H.9.	1 ,,
Spratt-Archer 37/6 No. 7.	1 ,,
July Six-Rowed	1 ,,
D.S.K. Binder	½ ,,
Golden Archer 2	1 ,,

The produce of these plots will be available in 1940 for further propagation and for the large scale variety experiments.

Second Pedigree Plots of Spratt-Archer 37 No. 3 were grown under contract with the following farmers in the neighbourhood of Ballinacurra :-

	Brls.	*Sts.*
M. Kelleher, Geragh, Ballinacurra	4	8
R. Scanlon, Geragh, Ballinacurra	5	0
R. Barry, Broomfield, Midleton	6	0
Wm. McAuliffe, Carrigatoher, Midleton	5	0
J. Reilly, Ballinabointra, Carrigtwohill	4	2
J. Leahy, Innegrega, Ballinacurra	5	8
TOTAL ..	30	2

The produce of these plots will be available for distribution as nucleus stocks of pedigree seed in the spring of 1940.

For a number of years the Department have had in operation a Scheme under which nucleus stocks of pedigree Spratt-Archer barley are distributed each year to members of the Irish Maltsters' Association, and others interested in seed barley distribution. Those who obtain such stocks undertake to have them grown with reliable farmers : to buy the produce, if suitable, for seed purposes and distribute it to growers in the following season. Under this Scheme 464½ barrels of Spratt-Archer 37 No. 3 were distributed to the following :—

		Brls.	*Sts.*
Messrs.	Beamish & Crawford, Ltd., Cork	10	0
,,	Minch, Norton & Co., Ltd.. Bagenalstown ..	15	0
,,	,, ,, Athy	50	0
,,	,, ,, Nenagh	20	0
,,	,, ,, Barracore ..	15	0
,,	,, ,, Stradbally ..	20	0
,,	P. J. Roche & Sons, Enniscorthy	10	0
,,	W. B. Nunn & Co., Wexford	10	0
,,	North Tipperary Maltings, Nenagh	25	0
,,	G. Read & Co., Ltd., Roscrea, Co. Tipperary ..	15	0
,,	F. A. Waller & Co., Ltd., Banagher, Offaly ..	15	0

		Brls.	Sts.
Messrs.	Birr Maltings, Birr, Offaly	10	0
,,	N. Hardy & Co., Ltd., Dundalk, Co. Louth ..	10	0
,,	Robert Gibney & Co., Ltd., Portlaoighise ..	10	0
,,	J. Bolger & Co., Ltd., Ferns, Co. Wexford ..	20	0
,,	A. J. M. Reeves, Athgarvan, Co. Kildare ..	4	0
,,	W. J. O'Keeffe & Son, Faythe Maltings, Wexford	10	0
,,	Cairn's Ltd., Drogheda, Co. Louth	15	0
,,	D. E. Williams, Ltd., Tullamore, Offaly ..	100	0
,,	P. & H. Egan, Ltd., Tullamore, Offaly ..	25	0
,,	J. & A. Tarleton, Ltd., Tullamore, Offaly ..	10	0
,,	Joshua Watson & Co., Ltd., Carlow	25	0
,,	,, ,, Leighlin Bridge ..	15	0
,,	E. Smithwick & Sons, Ltd., Kilkenny	3	0
,,	Latchford & Sons, Tralee, Co. Kerry	2	8
	TOTAL ..	164	8

In addition to the above, the following quantities of Seed Barley wer also distributed :-

	Brls.	Sts.
July Six-Rowed.		
To the Agricultural School, Athenry, Co. Galway ..	10	0
D.S.K. Binder.		
To the Agricultural School, Athenry, Co. Galway ..	5	14

All seed sown at the Ballinacurra Cereal Station and all seed distributed therefrom were treated with Agrosan powder.

INSPECTION OF GROWING CROPS FOR SEED PURPOSES.

In order that those who co-operate in the Scheme for the Distribution of Pedigree Spratt-Archer seed might have information regarding the suitability of the produce for seed purposes, the Department arranged to have the crops which were grown for this purpose inspected before harvest. For inspection purposes the crops were divided into three classes: (1) Crops grown from seed obtained from Ballinacurra in 1939; (2) Crops grown from seed which

was the produce of seed obtained from Ballinacurra in 1938, and (3) Crops grown from commercial seed of Spratt-Archer 37 No. 3. As regards (3) inspections were only made in those cases where the Maltsters concerned were of opinion that they would not have sufficient seed otherwise and so required inspections made of the most promising crops grown from commercial stocks.

A total of 4,168 statute acres was inspected, of which 3,525 acres were reported as likely to produce grain suitable for seed purposes, if properly harvested. Of the 706¾ acres inspected under category (1) 2½ acres were rejected on account of being sown in a field with other barley, and 9 acres were rejected because the crop was poor.

In category (2) 2,339⅝ acres were inspected and 511¾ acres or 21.8 per cent. were rejected. The rejections were chiefly due to other barley having been sown in the same field, poor crops, smut and the presence of an undue amount of wheat and oats. Under category (3) 1,117½ acres were inspected and 115½ acres or 10.3 per cent. were rejected for the same causes as in category (2) except that no smut was reported as being present in any of the crops in this class.

From the number of crops rejected it is apparent that some distributors did not take sufficient care in the selection of growers and in having the seed properly treated with a fungicidal dressing before it was despatched to growers. It is desirable that firms co-operating in this Scheme should exercise care in selecting growers and in treating the seed with a suitable powder dressing before sowing.

LARGE SCALE VARIETY EXPERIMENTS.

These experiments were carried out at ten centres in seven counties, one each in Cork, Tipperary, Kilkenny, Kildare and Louth, two in Offaly and three in Wexford. The seed used for the experiments was produced on the First Pedigree Plots established at the Cereal Station, Ballinacurra, Co. Cork, in 1938. The area of the plots throughout was 1 statute acre, except in the case of Spratt-Archer 37/6 No. 7, which was ⅞ of an acre at each centre, and the seeding was at the rate of 10 stones per statute acre. All the seed was dressed with Agrosan powder at the rate of 8 ozs. per barrel of seed.

The four varieties sown at all ten centres were Spratt-Archer 37 No. 3, Spratt-Archer 37 No. 3 H.9, Spratt-Archer 37/6 No. 7 and Golden Archer 2.

Sowing conditions were, on the whole, favourable and all the plots were sown by 18th April. The harsh weather in May followed by the drought in June retarded growth very much and at the end of the latter month the

appearance of the plots was not promising. The wet weather conditions during July brought about a marked improvement in the crops. There was a considerable amount of second growth in all plots, especially in the plots of Spratt-Archer 37/6 No. 7. This variety came into ear about ten days earlier than the other varieties and in consequence it suffered most from the effects of drought. The straw was very short on all plots and no lodging occurred at any centre.

The names and addresses of the growers, the nature of the soil and subsoil, the crops which were grown in the two previous years and the dates of sowing and harvesting are set out in Table I.

TABLE I.

Large Scale Barley Variety Experiments, 1939.

Centre	Name and Address of Grower	Description of Soil	Previous Crops	Date of Sowing	Date of Harvesting
1	Wm Tait, Rostellan, Co Cork	Medium Loam Sub-soil Shale	1937 Barley 1938 Roots	29/3/39	12/8/39 23/8/39
2	Ml Carroll, Belleen, Nenagh	Strong Loam Sub-soil Limestone	1937 Beet 1938 Wheat	13/4/39	4/9/39 9/9/39
3	Wm Watkins, Coolnagrower, Birr	Light Loam Sub-soil Limestone	1937 Barley 1938 Roots	12/4/38	2/9/39 9/9/39
4	D O'Brien, Ballinamore, Tullamore	Gravelly Loam Sub-soil Limestone	1937 Oats 1938 Roots	3/4/39	28/8/39 30/8/30
5	M P Minch, Rockfield, Athy	Deep Loam Sub-soil Gravel	1937 Barley 1938 Roots	20/3/39	17/8/39 21/8/89
6	J Bryan, Dunbell, Kilkenny	Deep Loam Sub-soil Limestone	1937 Roots 1938 Wheat	18/4/39	4/9/39 9/9/39
7	Ml Howlett, Ramsgrange, Wexford	Stiff Loam Sub-soil Shale	1937 Oats 1938 Roots	31/3/39	29/8/39 2/9/39
8	P Byrne, Ballygrangans, Wexford	Sandy Loam Sub-soil Gravel	1937 Barley 1938 Roots	6/4/39	18/8/39 19/8/39
9	D Morris, Tomahurra, Enniscorthy	Shaly Loam Sub-soil Shale	1937 Oats 1938 Roots	24/3/30	22/8/39 16/8/39
10	Mrs. Segrave, Dunany, Dunleer.	Strong Loam Sub-soil Gravel	1937 Wheat 1938 Turnips	11/4/39	2/9/39 6/9/39

In Table II are set out the weights of grain per statute acre, the commercial value of the grain as determined by independent valuers, and the total value of the grain, including the screenings which were valued at 6d. per stone throughout.

TABLE II.

Large Scale Barley Variety Experiments, 1939. Yield and Value of Grain per Statute Acre.

CENTRE	SPRATT ARCHER 37 No. 3				SPRATT-ARCHER 37 No. 3 H.9				SPRATT-ARCHER 37/6 No 7				GOLDEN-ARCHER 2.			
	Yield of		Value per Barrel	*Total Value including Screenings	Yield of		Value per Barrel	*Total Value including Screenings	Yield of		Value per Barrel	*Total Value including Screenings	Yield of		Value per Barrel	*Total Value including Screenings
	Dressed Grain	Screenings			Dressed Grain	Screenings			Dressed Grain	Screenings			Dressed Grain	Screenings		
	brls sts.	sts	s d.	£ s. d	brls sts	sts	s d.	£ s d.	brls. sts	sts	s. d.	£ s d.	brls. sts	sts.	s. d.	£ s d.
Cork: Wm. Tait	12 4	3	24 2	14 17 6	12 4	3	24 1	14 16 6	11 14	2	24 2	14 8 0	11 9	3.5	24 4	14 3 1
Tipperary: Ml. Carroll	13 5	6	24 3	16 5 10	8 10	4	24 2	10 10 5	10 1	5	24 2	12 5 8	9 12	4.5	24 4	11 19 6
Offaly: Wm. Watkins	11 6	.5	24 2	13 15 2	10 8	5	24 1	12 13 1	10 8	.5	24 0	12 12 3	9 5	.5	24 2	11 5 4
D. O'Brien	14 12	3.5	24 2	17 18 2	14 4	3.5	24 1	17 4 11	12 0	4	24 2	14 12 0	12 12	2.5	24 4	15 11 6
Kildare: M. P. Minch	14 5	1.5	24 2	17 6 8	14 9	1.5	24 3	17 13 11	12 7	1	24 1	15 0 0	13 0	1.5	24 2	15 14 11
Kilkenny: J. Bryan	12 8	12	23 8	15 1 10	12 9	12	23 8	15 3 4	12 6	7	23 8	14 16 4	11 6	11	23 9	18 15 8
Wexford: Ml. Howlett	12 9	2	23 11	15 1 5	13 2	3	24 0	15 16 6	10 14	1	23 7	12 17 0	12 3	1.5	23 10	14 11 3
P. Byrne ...	10 0	3	23 9	11 19 0	11 12	2.5	23 11	14 2 3	7 8	1.5	23 8	8 18 3	11 7	2	24 1	13 16 5
D. Morris	11 9	3.5	24 2	14 1 2	10 3	2.5	24 0	12 5 9	5 12	2.5	23 9	6 17 10	9 0	3	24 3	10 19 9
Louth: Mrs. Segrave	12 8	1.5	23 11	14 19 8	12 5	1.5	24 0	14 16 3	12 9	1	23 9	14 18 10	11 14	2	23 11	14 5 0
Total ..	125 2	36.5	—	151 6 5	120 2	34	—	145 2 11	105.15	25.5	—	127 6 2	112 4	32	—	136 2 5
Average	12 8	3.5	24 0	15 2 8	12 0	3.5	24 0	14 10 3	10 10	2.5	23 11	12 14 7	11 4	3	24 1	13 12 3

*Screenings valued at 6 pence per stone.

The standard variety, Spratt-Archer 37 No. 3, gave the highest average yield of grain and the highest monetary return per acre. It outyielded Spratt-Archer 37/6 No. 7 and Golden Archer 2 at nine of the ten centres. Although the standard variety gave a higher average yield than Spratt-Archer 37 No. 3 H. 9, it was superior to the latter at only five centres.

The results of analyses of the produce for the various plots are set out in Table III. It will be observed that the percentage of nitrogen in Spratt-Archer 37/6 No. 7 was higher at all centres than that in Spratt-Archer 37 No. 3, the average being 1.66 per cent. for the former and 1.51 per cent. for the latter. This indication of the inferior malting quality of Spratt-Archer 37/6 No. 7 was borne out by subsequent malting and brewing trials. A remarkable feature of the produce of the experimental plots was the high 1,000 corn weight, the figures for which were much above normal, indicating exceptionally well-filled grain.

TABLE III.

Large Scale Barley Variety Experiments, 1939. Analysis of Produce.

GROWER	SPRATT-ARCHER 37 No. 3				SPRATT-ARCHER 37 No 3 H 9				SPRATT-ARCHER 37/6 No 7				GOLDEN ARCHER 2			
			On Dry Matter				On Dry Matter				On Dry Matter				On Dry Matter	
	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms.	Nitrogen %	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms.	Nitrogen %	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms.	Nitrogen %	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms	Nitrogen %
Wm. Tait	53.9	20.1	40.8	1.53	53.9	19.0	40.6	1.32	54.4	18.1	42.2	1.56	53.9	19.3	41.8	1.57
Ml. Carroll . .	54.9	19.1	43.4	1.48	54.9	19.2	42.8	1.45	54.9	19.2	43.2	1.60	55.1	19.2	43.6	1.48
Wm Watkins ..	52.8	20.7	39.0	1.50	52.5	20.6	39.0	1.49	53.5	20.4	39.2	1.62	53.1	21.5	39.2	1.52
D. O'Brien .	54.0	19.1	40.0	1.58	54.0	19.1	39.2	1.55	53.5	19.7	41.1	1.66	54.0	20.1	40.5	1.64
M. P. Minch	53.9	19.4	42.0	1.51	54.1	19.4	42.1	1.50	53.6	18.9	43.4	1.69	54.1	19.6	42.8	1.51
J. Bryan .	51.8	19.0	35.9	1.58	51.3	19.0	34.1	1.56	50.4	21.4	36.1	1.68	51.9	19.1	37.5	1.59
Ml. Howlett .	51.3	20.7	36.5	1.38	51.9	20.5	36.8	1.42	51.1	21.0	37.0	1.56	51.6	20.7	37.1	1.46
P. Byrne .	53.1	19.9	35.1	1.53	53.2	19.9	35.1	1.55	51.5	20.7	35.6	1.69	54.7	19.9	37.2	1.68
D. Morris	53.6	19.0	38.3	1.48	53.8	18.6	36.6	1.55	52.2	19.5	36.1	1.71	54.2	19.6	38.3	1.54
Mrs Segrave .	54.3	20.4	40.1	1.58	54.2	20.1	39.3	1.58	53.9	20.1	40.6	1.83	53.7	21.5	40.6	1.64
Total . .	533.6	197.4	391.1	15.15	533.8	195.4	385.6	15.17	529.0	199.0	394.5	16.60	536.3	200.5	398.6	15.63
Average ...	53.36	19.74	39.11	1.51	53.38	19.54	38.56	1.52	52.90	19.90	39.45	1.66	53.63	20.05	39.86	1.56

HALF DRILL STRIP EXPERIMENTS.

Two of these experiments were carried out on the Ramhill Farm of Messrs. J. H. Bennett, Ltd. Each trial consisted of twenty-two strips of each variety under test, a strip being half the width of the sowing machine.

In No. 1 Experiment the produce of the 1938 field plot of Spratt-Archer 37 No. 3 was tested against the produce of the Second Pedigree Plot of the same variety, the object being to ascertain if the younger generation was maintaining the desirable qualities of the older generation. To ensure even sowing the seed in each half of the corn drill was changed over for the sowing of the second half of the experiment. In order to maintain the sequence of the strips, the machine was driven up the field idle before commencing to sow the second half of the experiment.

The results which are set out in Table IV. show that the returns from the two generations were very similar.

In No. 2 Experiment the object was to ascertain whether each side of the machine sowed an equal amount of seed and, if not, whether the different rates of seeding had any effect on the resulting crop. This trial was carried out with 1st pedigree seed of Spratt-Archer 37 No. 3. An equal amount of seed was put into each side of the machine before sowing commenced, and after sowing was completed the seed left over was removed and weighed. It was ascertained that the left hand side of the machine sowed, on the average, at the rate of 3.37 lb. of seed per half drill strip while the right hand side sowed at the rate of 3.16 lb. per half drill strip. These rates are the reverse of those obtained last year in a similar trial when the right hand side of the machine sowed at a slightly higher rate than the left hand side.

The results are also set out in Table IV. They show that the strips sown with the left hand side of the machine gave slightly the higher average yield. The difference, however, is not significant. Thus while it has been established that the left and right hand sides of the machine sow at different rates and while there is no evidence to suggest that the resulting variation is sufficient to introduce error into an experiment conducted by the half drill strip method, the changing over of the seed half way through the trial is a desirable precaution.

TABLE IV.

Half Drill Strip Experiments, 1939.

No. 1 EXPERIMENT						No. 2 EXPERIMENT					
Field Plot			Second Pedigree			Left Side			Right Side		
	st.	lb.		st.	lb.		st.	lb.		st.	lb.
a	2	6.5	B	2	2	a	3	4	B	3	5
C	2	10	b	2	0	C	3	8	b	3	6
c	2	4	D	2	8	c	3	4	D	3	3
E	2	7	d	2	3	E	3	3	d	2	11
e	2	6	F	2	5.5	e	2	10	F	2	12
G	2	12.5	f	2	12	G	2	12	f	2	12
g	2	9	H	3	1	g	2	12.5	H	3	0.5
I	3	0.5	h	3	3	I	2	13	h	2	11.5
i	2	13.5	J	3	0	i	3	2	J	3	1
K	3	2	j	2	10.5	K	3	3.5	j	2	12.5
k	3	5	L	3	0.5	k	3	2.5	L	2	13.5
M	3	4	l	2	12	M	3	2	l	2	10.5
m	3	3	N	3	1.5	m	3	1	N	3	2
P	2	10.5	n	3	2	P	3	3	n	2	13.5
p	3	0.5	Q	2	13	p	2	12	Q	3	2
R	3	1.5	q	2	13.5	R	2	12	q	2	12.5
r	3	2	S	2	10.5	r	2	11	S	2	9.75
T	2	13.5	s	3	1	T	2	9	s	2	7
t	2	10.5	V	3	0	t	2	6	V	2	6
W	2	11	v	3	0.5	W	2	6	v	2	6.5
w	3	5.5	X	2	8	w	2	10	X	2	6
Y	3	2	x	3	1.5	Y	2	4.5	x	2	11.5
TOTAL ..	64	0		61	11		64	11		63	7.25
Average	2	12.7		2	11.3		2	13.2		2	12.4
Average Moisture %	16.6			16.6			17.2			17.5	
Average Nitrogen %	1.67			1.73			1.62			1.60	
Average Weight of 1,000 Corns (grms)	41.5			41.1			41.8			41.3	
Relative Malting Quality	100.0			101.5			100.0			100.5	

SMALL SCALE QUANTITATIVE EXPERIMENT, 1939.

This experiment was conducted in the Cage at the Cereal Station. Eight varieties were included and were sown in a series of randomised blocks. There were fourteen replications of each variety.

Spratt-Archer 37 No. 3 was sown as the control and the other seven varieties were :—Spratt-Archer 37/12/41, Archer, New Cross, Chevallier (Local), Spratt-Archer x Glabron 1, Spratt-Archer x Glabron 2 and Spratt-Archer x Glabron 3.

The results which are set out in Table V show that the standard variety Spratt-Archer 37 No. 3, gave a significantly higher yield than any of the others. This variety also had the lowest percentage of nitrogen and the highest malting quality.

TABLE V.

Small Scale Quantitative Experiments, 1939.

Average of Fifteen Plots.

Variety	Weight of Ears	Weight of Grain	Nitrogen %	Weight of 1,000 Corns	Relative Malting Quality
	Grms.	Grms.		Grms.	
Spratt-Archer 37 No. 3 ..	287.4	218.3	1.52	43.6	100.0
New Cross	282.4	208.7	1.65	42.9	94.9
Spratt-Archer 37/12/41 ..	281.3	204.9	1.60	41.3	95.6
Archer	273.5	198.9	1.67	42.2	96.1
S.A. x Glabron 2	272.7	186.4	1.64	45.4	96.1
S.A. x Glabron 1	271.4	181.4	1.63	44.2	96.8
Chevallier (Local)	241.9	179.6	1.76	44.0	93.1
S.A. x Glabron 3	255.0	178.8	1.64	44.0	96.5

AUXIN EXPERIMENTS.

In last year's report reference was made to some trials designed to find the effect, if any, of Naphthyl-acetic Acid and Indolyl-acetic Acid on the germination of barley and on the subsequent development of plants from treated seed. In these trials the two auxins were applied to the seeds in powder form suitably mixed with a proprietary mercurial seed disinfectant which acted not only as a fungicide but also as a spreader for the auxins. Since it was necessary to apply the powdered auxins in such small dressings as one part per million by weight of treated seed this method was open to the criticism that no guarantee could be given that each individual grain in a treated sample carried the requisite load of auxin, and a more exact method of application was eventually worked out at the Department's Seed Testing Station by using solutions of the salts in question.

Since the object aimed at in these trials was the application to each seed of a specific amount of auxin it was necessary to decide by experiment on a method of dipping or soaking the seeds in auxin solutions of various strengths so that each wetted seed carried the necessary amount of salt in solution on its surface. After an extensive series of preliminary trials, which need not be discussed here, it was decided to fix on a five minute dip as the standard time of treatment and repeated trials under such conditions showed that

the individual grains in a bulk of barley retained on their surface approximately 16% by weight of water after draining.

With this as a working basis and using 1% solutions of Naphthalene-acetic Acid and Indolyl-acetic Acid it was possible, by making the necessary dilutions, to arrange for a series of treatments where the load of auxin varied from 2 p.p.m. to 160 p.p.m. on each batch of treated grain. Each experimental unit consisted of 200 grms. of barley which were steeped for five minutes in 200 c.c.s. of the auxin solution of the required strength, then drained on a wire gauze and immediately dried in a current of warm air. The solutions were so arranged that loads of each auxin amounting to 2, 4, 8, 80 and 160 p.p.m. were deposited on the treated seeds.

Preliminary trials had shown that at the higher rates a certain amount of injury was caused to the grain and this may be seen from the germination results which appear in Table VI.

TABLE VI.

Showing the Germination of Barley Grains Treated with Auxins.

Seed Treatment	GERMINATION %					
	3 days	5 days	6 days	7 days	8 days	10 days
Control	96	96	96	98	99	99
Naphthalene-Acetic Acid :—						
2 p.p.m.	91	96	96	97	97	97
4 ,, ...	93	95	96	96	96	96
8 ,, ...	92	96	97	97	97	98
80 ,, ...	—	90	91	92	93	93
160 ,, ...	—	86	87	89	89	89
Indolyl-Acetic Acid :—						
2 p.p.m.	91	93	94	94	95	95
4 ,, ...	90	95	96	97	97	98
8 ,, ...	89	95	95	97	97	97
80 ,, ...	89	93	94	94	95	95
160 ,, ...	87	95	95	95	95	95

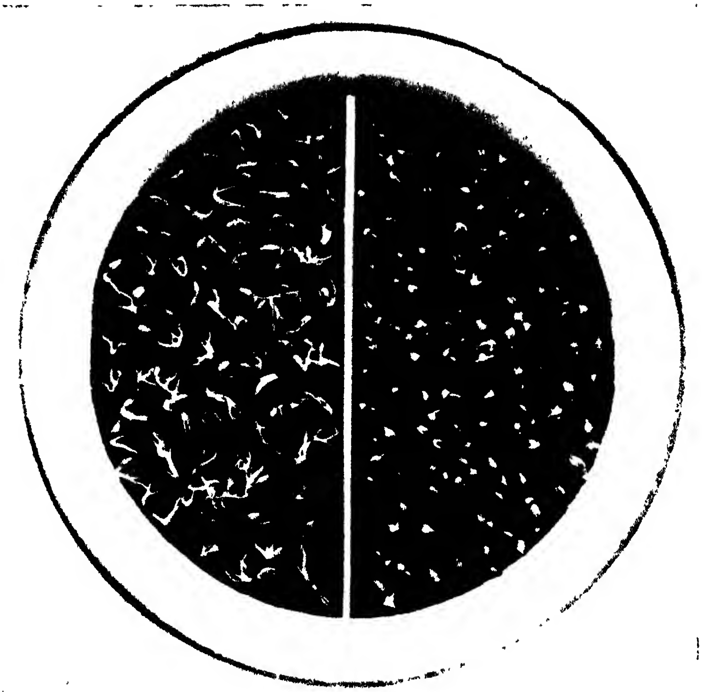


Fig. 1.

Control Barley (left) showing normal germination in four days. Barley treated with naphthalene-acetic acid 160 p.p.m. (right) showing reduced root development. ⅔ nat. size.

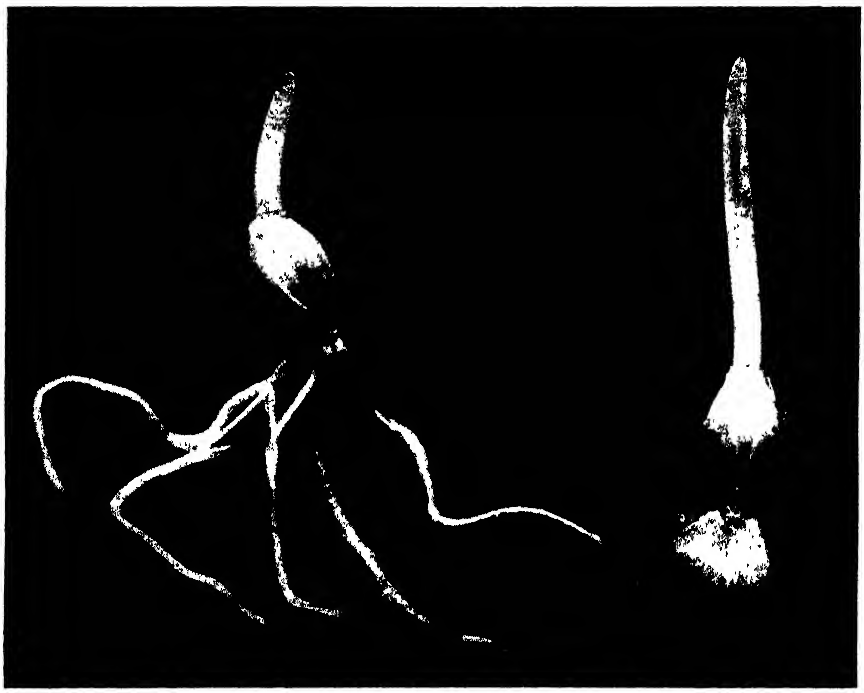


FIG. 2.

Control and treated Barley grains showing on left normal germination, and on right reduced root development and increased plumular growth resulting from treatment with naphthalene-acetic acid 160 p.p.m. Six days in test. ×3.

The injurious effect of the treatment is especially noticeable in the case of Naphthalene-acetic Acid where the 80 p.p.m. and 160 p.p.m. treatments delayed germination so much that it was not possible to make counts after three days (see fig. 1) and even after seven days the radicles of the seeds treated with these concentrations had not elongated much though an abnormal development of root hairs had taken place. There was evidence to suggest, however, that where root development was reduced as a result of the treatment, plumular growth was considerably increased (see fig. 2).

A series of pot culture trials were carried out in triplicate under greenhouse conditions with some of the treated grain. The soil used was from an old pasture and thirty seeds from each treated lot were sown per pot. After seven days a number of seedlings appeared in all pots but these from seeds treated with Naphthalene-acetic Acid at rates of 80 p.p.m. and 160 p.p.m. were few in number and relatively small in size. After a further two days the total number of plants in each series was counted and the number in each pot reduced to twenty-five. During the removal of the superfluous seedlings their root systems were carefully examined but no difference could be seen between any of the treated lots and the controls, which suggests that the adverse effect of Naphthalene-acetic Acid (160 p.p.m.) on root development as seen in the laboratory tests in sand saucers, was prevented under soil conditions. The total seedling production in each series is shown in Table VII and these results bear a close relationship to the germination figures obtained under laboratory conditions.

TABLE VII.

Showing the Total Number of Seedlings Produced in Each Series of Pot Cultures.

Treatment	Total Number of Seedlings
Control	87
Naphthalene-Acetic Acid :—	
2 p.p.m.	86
4 „	88
8 „	84
80 „	84
160 „	77
Indolyl-Acetic Acid :—	
2 p.p.m.	85
4 „	88
8 „	87
80 „	86
160 „	89

During the progress of these trials a very considerable amount of variation was noted between the plants in the various pots but this variation also appeared in many cases between the three pots comprising one series, and when the weights of straw and grain were determined at the end of the trial there was no evidence to show that the treatment of the seed with either auxin had any material effect on the final result.

In addition to the above experiments, portion of the treated seed was sown in the open field at the Ballinacurra Cereal Station. The arrangement of the experiment was a Latin square for each auxin, and each Latin square consisted of four replications of the control and the seed treated at the rate of 4 p.p.m., 8 p.p.m., 80 p.p.m., and 160 p.p.m.

The germination of the grain in the plots sown with the seed treated at the rates of 80 p.p.m. and 160 p.p.m. was delayed, and the plants on these plots did not appear above ground for some days after those on the other plots; this was especially the case with the Naphthalene-acetic acid at 160 p.p.m. After the plants on these plots did appear they made rapid growth, so that in a relatively short time the plots had all levelled up, and for the rest of the growing period there was no apparent difference between them. Table VIII sets out the average ear weight and grain weight of the plots and a summary of the analysis. It will be seen that the high concentration of Naphthalene-acetic acid, 160 p.p.m., as well as having delayed germination, had a decidedly depressing effect on the yield. The heavy dressing of Indolyl-acetic acid also appears to have had a slightly depressing effect on the yield. The lighter dressings of both auxins do not appear to have had any significant effect.

TABLE VIII.

Small Scale Auxin Experiments, 1939.

	NAPHTHALENE-ACETIC ACID										INDOLYL-ACETIC ACID									
	Control		4 p.p.m.		8 p.p.m.		80 p.p.m		160 p.p.m		Control		4 p.p.m.		8 p.p.m		80 p.p.m		160 p.p.m.	
	Ear Wt.	Grain Wt.	Ear Wt.	Grain Wt.	Ear Wt.	Grain Wt	Ear Wt	Grain Wt.	Ear Wt.	Grain Wt.	Ear Wt.	Grain Wt	Ear Wt	Grain Wt	Ear Wt.	Grain Wt	Ear Wt.	Grain Wt	Ear Wt.	Grain Wt.
	261.6	205.4	329.7	248.2	303.7	241.1	334.0	254.6	271.8	204.6	297.0	235.6	340.8	265.0	215.6	168.8	309.6	244.5	310.7	239.6
	310.8	245.5	334.3	251.7	322.6	254.3	298.4	235.8	276.5	211.6	209.5	167.4	302.3	238.7	328.8	261.3	288.0	220.5	344.3	270.5
	356.9	277.6	317.4	243.9	267.8	220.4	288.6	216.0	262.3	197.1	309.0	254.6	311.8	242.7	279.6	212.2	282.0	225.5	288.6	327.8
	348.8	245.0	285.0	215.2	321.9	240.1	311.0	240.0	237.5	197.8	338.9	266.1	297.8	227.1	331.2	255.3	333.6	231.0	301.1	124.9
	291.7	228.1	247.1	196.5	301.2	240.3	355.8	266.7	239.8	201.7	258.1	202.2	289.4	217.4	263.3	206.7	318.7	251.0	300.3	224.0
TOTAL	1569.8	1201.6	1513.5	1155.5	1517.2	1196.2	1587.8	1213.1	1287.9	1012.8	1412.5	1125.9	1542.1	1190.9	1418.5	1104.3	1531.9	1172.5	1545.0	1086.8
Average Weight	313.9	240.3	302.7	231.1	303.4	239.2	317.5	242.6	257.6	202.5	282.5	225.2	308.4	238.2	283.7	220.8	306.4	234.5	309.0	217.3
Nitrogen %	—	1.31	—	1.39	—	1.35	—	1.39	—	1.43	—	1.33	—	1.37	—	1.36	—	1.33	—	1.35
Weight of 1,000 Corns	—	43.7	—	43.1	—	44.6	—	44.0	—	43.9	—	43.3	—	43.1	—	43.0	—	43.6	—	44.1
Relative Malting Quality ...	—	100.0	—	100.3	—	100.1	—	100.2	—	100.2	—	100.0	—	100.1	—	100.1	—	100.4	—	100.1

An examination of the roots in all the plots after the crop had been harvested did not show any visible differences. Likewise the analysis of the produce did not show any significant differences.

RATE OF SOWING EXPERIMENT.

This experiment, which was laid down at the Cereal Station, Ballinacurra, was undertaken with a view to ascertaining the effect on the resulting crop of sowing barley at different rates.

The rates of sowing aimed at were six stones, 10 stones and 14 stones per statute acre. The trial consisted of thirty-six strips, including twelve at each rate of sowing. The width of a strip corresponded to that of the corn drill. The strips were 90 yards long and those sown at the different rates were arranged in a balanced layout in order to minimise the effect of soil variation. The machine was set to sow each series of strips at the rates referred to above and after the sowing of each series was completed the grain remaining in the machine was weighed. It was thus possible to calculate the exact rate at which each series was sown. The machine did not sow exactly as required and the actual rates were : 5.44 stones, 9.34 stones and 14.01 stones per statute acre.

During early summer the strips sown at the low rate looked very poor. The ground was not sufficiently well covered and those strips appeared to suffer most from the effect of the drought. There was little visible difference between the strips sown at the medium and high seeding rate during the growing season, but after the barley came into ear the crop on the strips sown at the highest rate appeared to be the most promising.

The results of the trial are set out in Table IX. The average yields for the medium and high rate of seeding were significantly superior to the average yield for the low rate. The strips sown at the high rate gave a somewhat greater gross yield than those sown at the medium rate, but when allowance is made for the extra quantity of seed sown the latter gave the highest nett yield per statute acre. The analysis of the produce showed that the grain produced on the strips sown at the high rate had the highest nitrogen content and the lowest 1,000 corn weight.

TABLE IX.

Rate of Sowing Experiment, 1939.

Yield of Grain.

Strip No.	Sown at the rate of 5.44 Stones per Acre	Strip No.	Sown at the rate of 9.34 Stones per Acre	Strip No.	Sown at the rate of 14.01 Stones per Acre
	st. lb.		st. lb.		st. lb.
1	6 0	2	7 5	3	8 0
6	9 13	5	9 5	4	8 5
9	9 6	7	9 11	8	9 12
10	9 1	12	9 9	11	9 11
14	9 6	15	10 6	13	9 11
17	9 5	16	10 8	18	10 9
20	9 11	21	10 6	19	10 10
23	9 1	22	10 0	24	10 9
27	7 5	25	9 1	26	9 3
28	6 12	30	8 4	29	8 9
31	6 13	32	8 4	33	9 12
36	8 11	35	9 1	34	9 5
Total ..	102 0		112 4		114 4
Average ..	8 7		9 5		9 7
Gross Yield per St. Acre	brl. st. lb. 11 9 2		brl. st. lb. 12 11 11		brl. st. lb. 12 15 6
Nett Yield per St. Acre	11 3 10		12 2 6		12 1 6
Nitrogen % ..	1.81		1.80		1.88
Weight of 1,000 Corns ..	43.4 grms.		41.6 grms.		38.7 grms.
Relative Malting Value ..	100.3		100		100.3

The results of this trial support current practice.

OATS.

Pure Line :—A single plant selection and a garden plot of Black Tartary Oats were grown at the Cereal Station in order to retain a pure line stock of this variety.

DEPARTMENT'S EXTENSION PLOTS.

In order to provide supplies of pedigree seed oats for merchants and others interested in the distribution of seed oats, stocks of Victory II and Ardri were grown under agreement with selected farmers in the neighbourhood of Ballinacurra. These stocks were grown, harvested, and threshed under the Department's supervision. The produce was kiln dried and cleaned and was made available for distribution in the spring of 1940.

The following are the names of the growers of these stocks, together with the acreage and the amount of seed sown :

Victory II.	*Acres*	*Brls.*	*Sts.*
Wm. Tait, Hermitage, Rostellan, Co. Cork ..	9	10	4
M. Kelleher, Geragh, Ballinacurra, Co. Cork ..	5	5	10
R. Scanlon, Geragh, Ballinacurra, Co. Cork ..	5	5	10
T. Twomey, Ballintubber, Carrigtwohill, Co. Cork	5	5	10
R. Barry, Broomfield, Midleton, Co. Cork ..	7	8	—
J. J. Smyth, Violet Hill, Cloyne, Co. Cork ..	9	10	4
TOTAL ..	40	45	10

Ardri.	*Acres*	*Brls.*	*Sts.*
Wm. Tait, Buckstown, Rostellan, Co. Cork ..	7	8	—
J. Hegarty, Ballinbeg, Rostellan, Co. Cork ..	7	8	—
J. Reilly, Ballinabointra, Carrigtwohill, Co. Cork ..	2½	2	10
P. McCarthy, Castleredmond, Ballinacurra, Co. Cork	3½	4	—
P. O'Keeffe, Ardra, Rostellan, Co. Cork	5	5	10
S. Northridge, Ballymacksliney, Midleton, Co. Cork	6	6	12
TOTAL ..	31	35	4

SCHEME FOR THE DISTRIBUTION OF PEDIGREE STOCKS OF SEED OATS.

Under this Scheme nucleus stocks of pedigree Victory II and Ardri raised at Ballinacurra in 1938. were distributed to Seed Merchants and others in the spring of 1939.

These pedigree stocks were supplied by the Department to merchants on condition that the latter would undertake to have the seed grown by reliable farmers, to purchase the produce if suitable and to retain it for seed purposes. In order to facilitate merchants the Department arranged for the inspection by County Agricultural Officers of the growing crops. Reports received at the end of the 1939 season indicated that in practically all cases the crops grown from the pedigree seed were likely to produce grain suitable for seed purposes. Consequently merchants who participated in this Scheme and who took sufficient care in the selection of growers and in the subsequent handling of the produce had large stocks of high-class home-grown seed oats available for sowing in the spring of 1940.

Under the above Scheme. foundation stocks of pedigree seed oats were supplied to the following in 1939 : --

Victory II.

Agricultural School, Clonakilty, Co. Cork.

Agricultural School, Athenry, Co. Galway.

Agricultural School, Ballyhaise, Co. Cavan.

Messrs J. H. Bennett, Ltd., Ballinacurra, Co. Cork.

,, D. & E. Williams, Ltd., Tullamore, Offaly.

,, J. P. Hopkins & Sons, Ltd., Wicklow.

,, D. H. Haskins & Son, Ltd., Wicklow.

Stephen Geraty. Carnew, Co. Wicklow.

Messrs. Birr Maltings, Ltd., Birr, Offaly.

The Bride Valley Stores, Tallow, Co. Waterford.

D. Daly, 4 Earl Street, Mullingar, Co. Westmeath.

Enniscorthy Co-op. Agricultural Society, Ltd., Enniscorthy, Co. Wexford.

Dungarvan Co-op Creamery, Ltd., Dungarvan, Co. Waterford.

Messrs. M. Kelliher & Sons, Ltd., Tralee, Co. Kerry.

,, O'Hara & Ryan, Ltd., Nenagh, Co. Tipperary.

P. J. Healy, Athleague, Co. Roscommon.

Messrs. O'Keeffe's, Tallow, Co. Waterford.

Ed. Hill, Kilmacthomas, Co. Waterford.

Henry Good, Kinsale, Co. Cork.

Kantoher Co-op. Agricultural and Dairy Society, Ltd., Newcastlewest, Co. Limerick.

Messrs. M. Rowan & Co. Ltd., Dublin.

,, Wm. Drummond & Sons, Ltd., Dublin.

,, N. Hardy & Co., Ltd., Dundalk.

,, F. A. Waller & Co. Ltd., Banagher. Offaly.

,, Latchford & Sons, Tralee, Co. Kerry.

,, Suttons, Ltd., Cork.

,, Dale & Sons, Cork.

,, J. Callaghan & Son, Glanworth, Co. Cork.

W. Boggan, Kilmuckridge, Co. Wexford.

Messrs. Minch, Norton & Co. Ltd., Bagenalstown, Co. Carlow.

,, McKenzies, Cork.

Irish Sugar Beet Growers' Association Ltd., Carlow.

Ardri.

Agricultural School, Clonakilty, Co. Cork.

Agricultural School, Athenry, Co. Galway.

Agricultural School, Ballyhaise, Co. Cavan.

Shelburne Co-op. Agricultural Society, Campile, Co. Wexford.

Messrs. D. H. Haskins & Son, Ltd., Wicklow.

S. Geraty, Carnew, Wicklow.

P. D. Buckley, Millstreet, Co. Cork.

D. Daly, 4 Earl Street, Mullingar, Co. Westmeath.

Enniscorthy Co-op. Agricultural Society, Ltd., Co. Wexford.

J. J. Furlong, Duncormick, Co. Wexford.

Messrs. M. Kelliher & Sons, Ltd., Tralee, Co. Kerry.

P. J. Healy, Athleague, Co. Roscommon.

Messrs. T. McKenzie & Sons, Ltd., Dublin.

,, M. Rowan & Co., Dublin.

,, N. Hardy & Co., Ltd., Dundalk.

,, J. H. Bennett, Ltd., Ballinacurra, Co. Cork.

,, Graigue Cullen, Corn & Coal Co., Ltd., Carlow.

,, Minch, Norton & Co. Ltd., Mhuine Beag, Co. Carlow.

,, McLysaght's Nurseries, Mallow, Co. Cork.

L. Doyle, Curraghboy, Athlone, Co. Westmeath.

Wm. Donnelly, Kiltoom, Athlone, Co. Westmeath.

M. Mannion, Curraghboy, Athlone, Co. Westmeath.

Wm. Naughton, Carrigeenmore, Roscommon.

P. O'Connell, Carrarea, Roscommon.

Rev. Brother Gillcece, The Monastery, Farragher, Roscommon.

M. T. Connolly, Agricultural Instructor, Wexford.

Garrett Byrne, Bree, Ballyhogue, Co. Wexford.

Irish Sugar Beet Growers' Association, Ltd., Carlow.

The Albert Agricultural College co-operated with the Department in the working of the foregoing Scheme, and distributed stocks to the following :—

Glasnevin Success III.

J. H. Bennett, Ltd., Ballinacurra, Co. Cork.

P. J. Colgan, Agricultural Instructor, Boyle, Co. Roscommon.

The Rector, Copsewood Agricultural College, Pallaskenry, Co. Limerick.

James Cunningham, St. Columban's College, Navan, Co. Meath.

Thomas J. O'Brien, Miltown Pass, Curraghboy, Athlone.

Thomas Heffernan, Elm Hill House, Clonlara, Limerick.

Agricultural School, Ballyhaise, Co. Cavan.

P. J. McDermott, Agricultural Instructor, Kells, Co. Meath.

John Lynch, Oldtown, Navan, Co. Meath.

FRUIT CROP REPORT, 1939.

Weather Conditions.

Cold, wet weather was experienced in the early months of the year, with the result that heavy losses occurred in Raspberry and Strawberry plantations.

The blossoming of Apples was from 12–20 days later than normal, but the scanty crop which was borne in 1938 favoured the development of plump, healthy fruit buds and resulted in a wealth of blossom. Mild, settled weather favoured pollination and a heavy set of fruit.

Hot, dry weather during May and June caused fruit drop in the case of Apples and Black Currants and retarded the development of Strawberries and Raspberries.

Rain came in late June and benefited mid-season and late maturing varieties of soft fruit so that better crops were obtained than had been anticipated earlier in the season.

Although the later months of the year were comparatively dull and sunless, Apples finished remarkably well and in the absence of storms at picking time the very abundant crop was harvested without much loss.

DISEASES AND PESTS.

Weather conditions being unfavourable for the early development of the apple scab fungus, attacks of the disease were much less severe than in other seasons and clean crops of apples were generally reported. Spraying for the control of scab is becoming more general throughout the country

Following a wet, sunless season which favoured the development of sappy growth and unripened wood it was reported that apple canker was prevalent even on varieties such as Bramley's Seedling which is normally regarded as being very resistant.

American Gooseberry Mildew caused damage in a number of counties.

The " Yellow Edge " virus disease of Strawberries was responsible for reduced yields, especially along the dry eastern coast.

CROP REPORTS.

The nature of the yield and of the quality of the fruit crops in each county is set-out in a general way in the following summary.

County	Gooseberries	Black Currants	Strawberries	Raspberries	Apples	Plums and Damsons	Other Fruits
Carlow	Very Good	Good	Light	Fair	Very Good	—	Fair to Good
Cavan	Good	Good	Fair	Good	Good	—	Fair to Good
Clare	Good	Good	Average	Fair to Average	Good	Good	Average to Good
Cork	Good to Very Good	Average to Good	Average	Below Average	Very Good	Fair to Good	Good
Donegal	Very Good	Fair to Good	Above Average	Average	Very Good	Very Good	Fair
Dublin	Very Good	Average to Good	Light to Average	Fair, under Average	Average to Good	Below Average to Good	Good
Galway	Very Good	Good	Fair	Fair to Good	Very Good	Fair to Good	Fair
Kerry	Good	Above Average	Fair to Good	Fair	Good	Fair	Good
Kildare	Good to Very Good	Good	Very Good	Very Good	Very Good	Fair to Good	Fair
Kilkenny	Good	Average	Good	Fair to Good	Very Good	Average	Fair to Good
Laoighis	Fair to Good	Good to Very Good	Fair to Good	Fair to Good	Very Good	Good	Good
Leitrim	Below Average	Fair	Fair	Heavy	Good	Poor	—
Limerick	Very Good	Good	Good	Fair	Very Good	Very Good	Good
Longford	Very Good	Average to Good	Fair	Good	Very Good	Good	—
Louth	Very Good	Fair	Fair	Good	Very Good	Light	Good
Mayo	Good	Average	Good	Good	Good	Very Good	Good
Meath	Very Good	Very Good	Good	Average to Good	Very Good	Very Good	Good
Monaghan	Good	Fair	Fair to Good	Good	Very Good	Good	Good
Offaly	Very Good	Very Good	Good to Very Good	Fair to Good	Very Good	Average to Good	Good
Roscommon	Very Good	Very Good	Good	Average	Very Good	Good	—
Sligo	Below Average	Average	Average	Fair	Very Good	Fair	—
Tipperary	Average to Good	Good	Average to Fair	Good	Very Good	Good	Good
Waterford	Very Good	Average to to Good	Very Good	Good	Very Good	Fair to Good	Good
Westmeath	Good	Average	Good to Very Good	Good	Very Good	Good	—
Wexford	Good	Fair	Good	Good	Very Good	Good	Good
Wicklow	Very Good	Very Good	Fair to Average	Fair to Good	Very Good	Average to Good	Good

Aphis was reported to have been less prevalent on Apples and other fruits. Attacks of other insect pests did not appear to have been more harmful than normally.

Bullfinches damaged fruit buds in certain counties, and Wasps, though not so injurious as in the previous year, were reported to have done some damage to ripening fruits.

MARKET PRICES.

STRAWBERRIES.

Outdoor Grown	7d. to 1/– per lb.
Forced	2/- to 4/– per lb.
Jam Fruit	£46 per ton

The Strawberry crop ripened early on account of the warm, dry weather and considerable quantities of home grown fruit were on offer before the imposition of the seasonal customs duty on supplies imported each year during the period from the 15th June to the 31st July. The result was that prices for early outdoor strawberries were, on the whole, lower than usual.

GOOSEBERRIES.

Green	2/6 to 3/- per 12 lb. chip.
Ripe	3/- to 5/- per 12 lb. chip.
Jam Fruit	£12 to £15 per ton.

RASPBERRIES.

In Punnets	5d. to 10d. per lb.
Jam Fruit	£40 to £18 per ton.

BLACK CURRANTS.

In Punnets	6d. to 10d. per lb.
Jam Fruit	£48 per ton.

APPLES.

Dessert Varieties.

2/– to 4/– per tray.
2/– to 3/– per chip.
8/– to 16/– per bushel.
up to 38/– per barrel of 9 stone.

Following the coming into operation of the Apples (Regulation of Import) Order on the 7th November, 1939, dessert apples were in increased demand and sold freely.

Culinary Varieties.

3/- to 5/- per Keg of 4 stones.
up to 15/- per barrel of 9 stones.

Jam Fruit	£3 to £4 per ton.
Cider Fruit	£3 10 0 per ton
For Canning Purposes ..	£10 per ton.

NATIONAL EGG-LAYING TEST, 1938-39.

NATIONAL EGG-LAYING TEST, 1938-39.

The Twenty-seventh Egg-Laying Test, conducted by the Department of Agriculture, was held at the Munster Institute, Cork, during a period of 46 weeks, beginning on the 1st October, 1938, and ending on 18th August, 1939. A total of 118 pens, each consisting of six pullets, having fulfilled the required conditions, was accepted and arranged in Sections as follows :—

Section I.—White Wyandotte	18 pens
Section II.—White Wyandotte (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1938)	27 ,,
Section III.—Rhode Island Red	16 ,,
Section IV.—Rhode Island Red (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1938)	17 ,,
Section V.—Any non-sitting breed	18 ,,
Section VI.—Any other general purpose breed	22 ,,

Station holders were, as heretofore, allowed to enter a second pen in one of the open sections on payment of the requisite entry fee.

As in the eight previous tests, only pullets which were certified by the Veterinary College, Ballsbridge, Dublin, as being non-reactors to the agglutination test for Bacillary White Diarrhœa, were accepted.

Minimum Weights.

The clause introduced in the regulations in 1928-29, whereby birds were required to be of specific minimum weights on arrival, was enforced. The following were the prescribed minimum weights for the respective breeds :—

All non-sitting breeds	3½ lb.
White Wyandotte	4½ lb.
Rhode Island Red	4½ lb.
Plymouth Rocks	5 lb.
Sussex	5½ lb.
Any other sitting breed . ..	5½ lb.

Eggs were graded as follows :—

Egg Grades.

Special Grade.—$2\frac{1}{8}$ oz. and over for the first eight weeks (1st October to 25th November, inclusive), $2\frac{1}{4}$ oz. and over throughout the remainder of the test.

First Grade.—A minimum of $1\frac{7}{8}$ oz. for the first eight weeks, a minimum of 2 oz. during the remainder of the test.

Second Grade.—Eggs which were not more than $\frac{1}{4}$ oz. less than the minimum weight prescribed for first grade eggs in the same period. Eggs which weighed less than the minimum weight prescribed for second grade eggs were recorded separately, but were not included in the score total on which awards were based.

Egg Yields.

Making no allowance for deaths, the average number of eggs per pullet was 188.3. The average number of eggs per pullet for which a record for the full 46-week period was available was 196.9 (see Table II.) These averages represent an increase as compared with the corresponding figures in the previous Test, in which the averages were 186.1 and 193.8 respectively. The average production per pullet during each of the twelve periods for each breed is given in Table III.

Egg Size

Nineteen pens were disqualified for producing more than 20 per cent. of second grade eggs. This figure was twenty for the previous Test. The respective percentages of each breed disqualified on this score in each of the twelve Tests completed since the clause was introduced in the regulations are given in Table IV.

Egg Weights

The average weight of egg for each of the competing breeds is listed in Table V The average weight per dozen eggs for all breeds was 26.2 oz., and only one pen was disqualified for failing to reach the standard weight of 24 oz per dozen. The figures for the previous test were 25.8 oz. and five respectively. In Table VI. are given the number and percentage of the different grades of eggs for each breed in respect of pullets which completed the full 46-week period.

Eggs under the Prescribed Weight for Second Grade

The number of ungraded eggs laid by pullets of each breed which completed the full 46-week period is given in Table VIII. The number of such pullets of all breeds which laid ungraded eggs was 140 and the number of ungraded eggs produced by them was 498. The corresponding figures for the previous Test were 160 and 558 respectively.

Copper Rings

Of the 657 birds which completed the full 46-week period, 236 or 35.9 per cent. laid 200 or more first grade eggs and not more than 20 per cent second grade (see Table IX.). Of these, 200 were leg-banded with numbered sealed copper rings as compared with 179 in the previous Test. Five birds were disqualified under the clause introduced in the Regulations governing the Test under revie which required that birds should, at the conclusion of the Test, be half-a pound over the minimum weight prescribed for the breed at the commencement of the Test. Copper rings were withheld from the following 36 birds which were not suitable for breeding purposes :

(*a*) Eye Defects :—

11 White Wyandottes.
3 White Leghorns.
2 Light Sussex.
2 Rhode Island Reds.

(*b*) Breed Standard Defects :

3 White Wyandottes
2 Rhode Island Reds
1 White Leghorn.

(*c*) Consistent Producers of Defective Eggs :

3 Rhode Island Reds.
1 White Wyandotte
1 White Leghorn.

(*d*) Under Prescribed Weight at Conclusion of Test :

4 Light Sussex.
1 Barred Rock.

(*e*) Constitutional Defects :—

1 Rhode Island Red.
1 Light Sussex.

The rings were distributed as follows :-

5 pens	.. ..	Five copper rings each.
9 ,,	.. ..	Four ,, ,, ,,
16 ,,	.. ..	Three ,, ,, ,,
28 ,,	.. ..	Two ,, ,, ,,
35 ,,	.. ..	One copper ring ,,

Particulars of eggs produced by the birds which were awarded copper rings are given in Table X.

Certificates of Merit. A total of 389 birds, representing 51.6 per cent. of the number surviving the full period of the Test, qualified for certificates. Of these, 200 birds (30.4 per cent.) were awarded Special Certificates (see Table X), and 189 birds (21.2 per cent.) Certificates (see Table XI).

Certificates were not awarded for pullets which produced over 20 per cent. of second grade eggs, nor for those showing breed or other defects.

Mortality During the course of the Test 51 birds died, representing a mortality of 7.2 per cent., and a decrease of 0.5 per cent. as compared with the previous Test. The deaths were confined to a small proportion of the pens, those occurring in four being accountable for over 23 per cent of the total. The distribution of total deaths was as follows :

4 pens	.. ..	3 deaths each.
10 ,,	.. ..	2 ,, ..
19 ,,	.. ..	1 death ,,

In the remaining 85 pens all birds completed the Test. Table XIII gives particulars of the pullets that died and the cause of death in each case. An analysis of the causes of death show that 43.1 per cent. of the mortality was due to Peritonitis and Oviductitis and 17.6 per cent. to Worm Infestation and Coccidiosis. Mortality from Tuberculosis was less than 4 per cent. of the total.

B.W.D. Test. All birds alive at the conclusion of the Test were submitted to the Agglutination Test for Bacillary White Diarrhoea, and there were three reactors.

Feeding. The system of feeding was similar to that employed during previous Tests. The birds were fed three times daily. The morning feed consisted of half the grain ration given as scratch feed in the litter, the mid-day feed of wet mash, and the evening feed of the remainder of the grain ration fed in troughs. Dry mash was fed *ad lib.* The mash, both dry and wet, was made up to the following formula :—

4 parts	by weight	Pollard.
3 ,,	,,	Bran.
2½ ,,	,,	Maize Meal Mixture.
½ part	,,	Finely Ground Oats.
1 ,,	,,	Fish Meal.

The grain mixture consisted of equal parts of wheat, oats and cracked maize. Vegetables, such as cabbage, kale, turnips and mangels,

were fed during certain seasons, and grit and shell were allowed *ad lib.* The following quantities of foods were consumed :—

Mixed Meals	48,644 lb.
Grain	25,401 ,,
Grit and Shell	3,752 ,,

NOTES ON COMPETING BREEDS.

WHITE WYANDOTTE.

Sections I and II

With a few exceptions the 45 pens of this breed were composed of well-developed birds of excellent quality. On arrival at the Test a couple of pens in each section were rather backward and took some time to come into full production. A few pens contained individual birds that showed standard breed defects, and individual birds in a small number of pens developed physical defects, mainly of the eyes. Apart from these exceptions the White Wyandottes reflected the greatest credit on their owners. Winter and total production were extremely satisfactory, as were egg size and quality. Five pens of this breed produced more than 20 per cent. of second grade eggs. The leading pen (No. 37, entered by Mrs. Graham, Ballagh Lodge, Donadea, Co. Kildare) in Section II. was also the best pen in the Test, and won the silver cup. During the 46 weeks of the Test this pen put up the very creditable score of 1,408 eggs, only two of which were second grade. The birds were excellent specimens of the breed. Mrs. Graham is to be congratulated on the distinction of breeding for two years in succession the best pen in the Test.

RHODE ISLAND RED.

Sections III and IV

These sections comprised a total of 33 pens. The great majority of the birds were well-developed, of good colour and typical of the breed. On arrival at the Test a few pens were backward and thereby suffered a handicap as they were not in full production during the early winter period. Individual birds were undersized, and a small number of birds were moulting on arrival at the Test. While the average winter production of the Rhode Island Reds was slightly less than that of the White Wyandottes, the average production of the former breed for the whole period of the Test was very satisfactory. Size and quality of egg were good, only six pens producing more than 20 per cent. second grade eggs.

ANY NON-SITTING BREED.

Section V

This section consisted of seventeen pens of White Leghorns and one pen of Anconas, an increase of five pens over the number that competed in the previous Test. The greater

number of White Leghorns were well-grown birds of good quality, but a few pens included birds that were backward on arrival at the Test. Notwithstanding that some moulting took place during the winter period, winter production was fairly satisfactory, and the records during the whole period reached a very high level. Egg size and quality also were very satisfactory.

The Anconas were good specimens of the breed, but production was not as high as in previous Tests.

ANY OTHER GENERAL PURPOSE BREED.

Section VI This section was composed of fifteen pens of Light Sussex, five pens of Barred Plymouth Rocks and two pens of Buff Plymouth Rocks. The increase of ten in the number of Light Sussex pens as compared with the previous Test is very satisfactory, and is evidence of the increasing popularity of this useful breed. The majority of the Light Sussex birds were of high quality, the colour and markings of the birds being particularly good. Barred and Buff Plymouth Rocks although only a small number competed were worthily represented. A couple of pens included individual undersized Light Sussex and Barred Plymouth Rock birds.

Production, egg size and quality were satisfactory in this section.

CONCLUSION.

The results of the Test are a striking tribute to the success achieved by poultry breeders in producing stock of the highest quality. The majority of the competing birds were good specimens of their breed, while the health and performance of most pens were very satisfactory.

The results confirm the view expressed in the final report of the previous Test that it is unnecessary to go beyond this country to procure high quality breeding stock of the principal breeds. In this connection the details set out in the report under review regarding the quality and performance of the birds entered should prove a useful guide to intending purchasers of breeding stock

Table I.

The following Table shows the number of pullets competing, the number of eggs laid, cost of food, return for eggs and gross profit for each of the twenty-seven tests held since 1912/13 :—

Forty-eight weeks ended	No. of Pullets	No. of Eggs Laid	Average Number per Bird	Average Value per Bird		Cost of Food per Bird		Average Price of Eggs per doz.	Return per Bird over Cost of Food	
				s.	d.	s.	d.	d.	s.	d
31st Aug., 1913	318	38,199	120.1	11	2.8	5	8	13.1	5	6.8
,, 1914	282	39,216	139.0	13	3.6	5	8.3	13.8	7	7.3
,, 1915	264	39,764	150.6	17	6	7	0.5	16.8	10	5.5
,, 1916	294	49,830	169.5	23	0.5	8	11.8	19.6	14	0.7
,, 1917	210	36,660	174.6	32	7.2	13	10.7	26.9	18	8.5
,, 1918	210	36,106	171.9	47	4	16	6	39.7	30	10.1
,, 1919	306	55,124	180.0	53	3.4	20	0	42.6	33	3.4
,, 1920	354	65,840	186.0	53	9	19	3.9	41.6	34	5.2
,, 1921	288	51,584	179.0	40	9.5	18	7.3	32.8	22	2.2
9th Sept., 1922	342	63,518	185.7	33	8.8	11	10	26.2	21	10.8
16th ,, 1923	* 198	38,519	194.5	27	11.5	12	1	20.8	15	10.5
15th ,, 1924	342	61,144	178.8	26	6.5	11	1.5	21.4	15	5.0
15th ,, 1925	348	63,755	183.2	27	4.9	10	5.2	22.6	16	11.7
15th ,, 1926	342	65,137	190.4	28	6.1	10	7.8	21.5	17	10.3
16th ,, 1927	492	93,912	190.9	26	10.7	9	3.6	20.3	17	7.1
16th ,, 1928	510	95,226	186.7	24	10.9	10	8	19.2	14	2.9
16th ,, 1929	540	101,820	188.6	28	8.5	11	0.5	21.9	17	8.0
16th ,, 1930	588	100,752	171.3	24	4.2	8	5.8	20.5	15	10.4
16th ,, 1931	588	111,180	189.1	24	4	7	3	18.5	17	1.0
15th ,, 1932	600	111,986	186.6	21	3.6	6	4.2	16.4	14	11.4
12th ,, 1933	606	113,047	186.5	17	11.6	5	1.8	13.9	12	9.8
10th ,, 1934	606	112,177	185.1	19	5	5	8.9	15.1	13	8.1
7th ,, 1935	702	131,384	187.1	18	3	6	7.7	14.0	11	7.3
3rd ,, 1936	702	130,940	186.5	20	7.5	7	3.2	15.9	13	4.3
Forty-six weeks ended										
18th Aug., 1937	708	125,621	177.4	20	10.5	7	7.2	16.9	13	3.3
,, ,, 1938	678	126,143	186 1	21	9.9	8	4.6	16 9	13	5.3
,, ,, 1939	708	133,306	188.3	23	0.6	8	8 8	17.6	14	3.8

It should be noted that the figures given in Table I above are based on the total number of pullets competing, no allowance having been made in respect of deaths during the test.

Taking the birds which died during the 1938–39 Test into account only up to the date of death, the average number of pullets for the whole period was 684.3, and the average number of eggs per bird 194.8. On this basis the average egg value per bird was 23s. 10.1d., the cost of food per bird 9s. 0.4d., and the return per bird over cost of food 14s. 9.7d.

Table II.

Average Egg Yield for each Breed.

Breed	No. of Pullets for full period	No. of eggs laid	Average No. of eggs per pullet	Grade Averages per Pullet: Special	First	Second
White Wyandotte ..	247	49,221	199.3	105.6	77.7	16.0
Rhode Island Red ..	189	37,886	200.5	83.8	89.2	27.5
White Leghorn	92	18,437	200.4	89.0	92.2	19.2
Light Sussex	87	15,922	183.0	75.7	85.3	22.0
Barred Rock	26	5,096	196.0	39.0	110.2	46.8
Buff Rock	10	1,852	185.2	105.0	63.6	16.6
Ancona	6	966	161.0	34.8	95.7	30.5
All Breeds ..	657	129,380	196.9	89.7	85.3	21.9

Table III.

Average Egg Yield per Pullet during each of the Twelve Periods.

Breed	Number of Pullets for full period	Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan 20	Jan. 21–Feb. 17	Feb 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug 4	Aug 5–Aug. 18	Average for full period
White Wyandotte	247	14.8	16.8	17.5	17.5	16.7	19.0	21.1	20.5	17.4	15.8	14.7	7.5	199.3
Rhode Island Red	189	12.3	15.8	17.0	16.7	16.6	20.4	22.1	21.4	18.6	17.2	15.0	7.4	200.5
White Leghorn	92	11.6	16.0	15.4	13.5	15.9	19.7	21.8	21.5	20.0	19.3	17.7	8.0	200.4
Light Sussex	87	14.5	14.7	15.5	15.6	15.8	19.4	20.5	18.7	14.7	14.1	13.2	6.3	183.0
Barred Rock	26	12.5	17.4	15.3	12.1	13.4	18.8	21.5	21.5	19.9	19.1	17.4	7.1	196.0
Buff Rock	10	13.4	16.3	18.2	18.1	16.1	19.6	17.6	18.5	15.3	13.4	13.7	5.0	185.2
Ancona	6	7.0	13.8	8.0	10.5	10.7	19.3	21.5	19.5	18.8	13.2	13.5	5.2	161.0
All Breeds ...	657	13.4	16.1	16.7	16.2	16.3	19.5	21.4	20.6	17.8	16.5	15.1	7.3	196.9

Table IV.

Percentage number of pens of each breed which were disqualified for producing more than 20 per cent. of Second Grade eggs in each of the Tests since the clause was introduced in the Regulations.

Breed	Percentage of Pens Disqualified											
	1927-8	1928-9	1929-30	1930-1	1931-2	1932-3	1933-4	1934-5	1935-6	1936-7	1937-8	1938-9
	%	%	%	%	%	%	%	%	%	%	%	%
White Leghorn ..	38.8	19.0	45.0	40.0	15.8	—	—	—	25.0	33.3	8 3	11.8
White Wyandotte	54.8	35.3	47.2	22.8	—	11.1	4.4	18.6	15.9	18.2	12.0	11.1
Rhode Island Red	40.9	25.0	40.0	35.7	—	7.1	12.9	15.0	11.6	25.0	25 0	18.2
Buff Rock ..	—	—	14.3	28.5	—	—	33.3	25.0	16.7	—	—	—
Barred Rock ..	*	50.0	33.3	50.0	25.0	33.3	33.3	16.7	57.1	60.0	50 0	60.0
Light Sussex ..	50.0	33.3	25.0	60.0	—	—	16.7	37.5	20.0	11.1	20.0	20.0
White Sussex ..	*	*	*	*	*	*	*	100.0	*	*	*	*
Black Minorca ..	—	—	—	—	—	*	*	100.0	*	*	*	*
Australorp .	100.0	—	—	*	*	*	*	*	*	*	*	*
Black Leghorn ..	—	*	*	*	*	*	*	*	*	*	*	*
Black La Bresse	100.0	*	*	*	*	*	*	*	*	*	*	*
Ancona	*	*	*	*	*	*	*	*	*	—	—	—
Average	44.7	26.6	39.8	32.6	4.0	7.9	10.9	17.9	17.9	22.9	17.7	16.1

* Breed not competing.

Table V.

Average Weight of Egg for each Breed.

Breed	Total Number of Eggs Laid	Total Weight of Eggs			Average Weight of Egg		Average Weight Per Dozen
		lb.	*oz.*	*dr.*	*oz.*	*dr.*	*oz.*
White Wyandotte ..	51,064	7,055	8	7	2	3.4	26.5
Rhode Island Red ..	38,317	5,173	9	7	2	2.6	25.9
White Leghorn ..	19,301	2,632	14	13	2	2.9	26.2
Light Sussex	16,249	2,196	10	5	2	2.6	26.0
Barred Rock	5,356	695	2	7	2	1.2	24.9
Buff Rock	2,053	285	14	5	2	3.6	26.7
Ancona	966	126	2	6	2	1.4	25.1
All Breeds ..	133,306	18,165	14	2	2	2.9	26.2

Table VI.

Number and Percentage of Special, First, and Second Grade Eggs for each Breed in respect of Pullets which completed the full 46-week Period.

Breed	Eggs Laid			Percentage Distribution		
	Special Grade	First Grade	Second Grade	Special Grade	First Grade	Second Grade
				%	%	%
White Wyandotte ..	26,080	19,184	3,957	53.0	39.0	8.0
Rhode Island Red ..	15,833	16,857	5,196	41.8	44.5	13.7
White Leghorn	8,184	8,483	1,770	44.4	46.0	9.6
Light Sussex	6,589	7,421	1,912	41.4	46.6	12.0
Barred Rock	1,015	2,865	1,216	19.9	56.2	23.9
Buff Rock	1,050	636	166	56.7	34.3	9.0
Ancona	209	574	183	21.6	59.4	19.0
All Breeds .	58,960	56,020	14,400	45.6	43.3	11.1

Table VII.

Average Number of First Grade Eggs per Pullet during the period 1st October to 29th December, inclusive (90 days).

Breed	Number of Pullets	Number of First Grade Eggs	Average Number of First Grade Eggs per Pullet
White Wyandotte	262	11,402	43.5
Rhode Island Red	194	7,527	38.8
White Leghorn	100	3,581	35.8
Light Sussex	89	3,489	39.2
Barred Rock	29	1,060	36.6
Buff Rock	11	564	51.3
Ancona	6	106	17.7
All Breeds	691	27,729	40.1

Table VIII.

Eggs under the prescribed weight for Second Grade.

Breed	Number of Pullets for full period which laid ungraded eggs	Number of ungraded eggs
White Wyandotte	41	182
Rhode Island Red	47	221
White Leghorn	27	57
Light Sussex	19	67
Barred Rock	4	18
Buff Rock	1	1
Ancona	1	2
All Breeds	140	498

Table IX.

Number and Percentage of Pullets of each Breed which laid 200 First Grade Eggs and over, and not more than twenty per cent. Second Grade.

Breed	Number of Pullets for Full Period	Number of Pullets which laid 200 First Grade Eggs and over	Percentage of Pullets which laid 200 First Grade Eggs and over
			%
White Wyandotte	247	102	41.3
Rhode Island Red	189	69	36.5
White Leghorn	92	34	37.0
Light Sussex	87	22	25.3
Barred Rock	26	6	23.1
Buff Rock	10	3	30.0
Ancona	6	—	—
All Breeds	657	236	35.9

SECTION PRIZES.

Section I.—White Wyandotte.

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Mr. M. Burchael, Kill, Co. Kildare.	£ s. d. 8 15 4	1,413	132	235.5
Second Prize (£7) Mrs. L. P. Cox. Victoria Park, Donnycarney, Dublin.	8 7 10	1,323	33	220.5
Third Prize (£5) Mrs. A. M. Murray, Tanderagee, Enfield, Co. Meath.	8 1 4½	1,292	99	215.3
Fourth Prize (£4) Miss B. Quain, Anglesboro, Co. Limerick, *via* Mitchelstown.	8 1 4½	1,322	151	220.8

Section II.—White Wyandotte (Station Holders).

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Mrs. K. F. Graham, Ballagh Lodge, Donadea. Co. Kildare.	£ s. d. 8 18 6½	1,408	2	234.7
Second Prize (£7) Mrs. M. Connolly, Carrigamore, Corvalley P.O., Dundalk, (Co. Monaghan).	8 13 8½	1,411	229	235.2
Third Prize (£5) Mrs. B. Martin, Corglass, Kingscourt, Co. Cavan.	8 6 3¾	1,284	28	214.0
Fourth Prize (£4) Miss K. Newman, Drinadaly, Trim, Co. Meath.	8 4 7½	1,321	52	220.2
Fifth Prize (£2) Mrs. J. Fahy, Corbally, Ballyglunin, Co. Galway.	8 1 3¾	1,301	23	216.8

Section III.—Rhode Island Red.

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	£ s. d. 7 14 5¾	1,236	115	206.0
Second Prize (£7) Capt. H. M. S. Redmond, Popefield, Athy, (Laoighis).	7 13 1½	1,206	39	201.0
Third Prize (£5) Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.	7 11 2	1,260	100	210.0
Fourth Prize (£4) Mrs. M. A. Miller, Millview, Lenamore, Rathowen, (Co. Longford).	7 10 9	1,238	189	206.3

Section IV.—Rhode Island Red (Station Holders).

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo.	£ s. d. 8 6 11¾	1,309	14	218.2
Second Prize (£7) Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	8 5 8¾	1,346	124	224.3
Third Prize (£5) Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.	8 4 0	1,364	181	227.3
Fourth Prize (£4) Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.	7 17 8¾	1,251	48	208.5

Section V.—Any Non-Sitting Breed.

Name and Address of Owner	Breed	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Mrs. F. Hanbidge, Blackrath, Ballytore, Co. Kildare.	White Leghorn	£ s. d. 8 12 7¾	1,462	132	243.7
Second Prize (£7) Miss K. Cunningham, Monreade, P. F., Naas, Co. Kildare.	White Leghorn	8 8 6	1,374	12	229.0
Third Prize (£5) Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	White Leghorn	8 4 7¼	1,324	42	220.7
Fourth Prize (£4) Mrs. M. Forster, Tattybrack, Rockcorry, Co. Monaghan.	White Leghorn	8 1 1¼	1,312	71	218.7

Section VI.—Any Other General Purpose Breed.

Name and Address of Owner	Breed	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Miss D. M. Place, Rosemount, New Ross, Co. Wexford.	Light Sussex	£ s. d. 8 4 9	1,337	153	222.8
Second Prize (£7) Mrs. M. Roche, Talbot Hall, New Ross, Co. Wexford.	Light Sussex	7 16 0	1,248	218	208.0
Third Prize (£5) Miss E. Walsh, Ballylemon Lodge, Cappagh, Co. Waterford.	Light Sussex	7 11 0¼	1,206	72	201.0
Fourth Prize (£4) Sister-in-Charge, Coolarne College, Athenry, Co. Galway.	Light Sussex	7 6 4¼	1,135	27	189.2

SPECIAL PRIZES.

The Special Prize of a Silver Cup (or its value, £10) for the *Pen* of pullets laying eggs of the highest market value during the Test has been awarded to Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare, for Pen No. 37 (White Wyandotte), which laid 1,408 eggs, value £8 18 6½d., and which also won first prize in Section II.

The Special Prize of a Silver Medal (or its value, £2) for the *Pen* of pullets of non-sitting breed laying the highest number of first grade eggs during the period from 1st October to 29th December, inclusive, has been awarded to Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick, for Pen No. 95 (White Leghorn), which laid 327 first grade eggs during this period.

The Special Prize of a Silver Medal (or its value, £2) for the *Pen* of Pullets of sitting breed laying the highest number of first grade eggs during the period from 1st October to 29th December, inclusive, has been awarded to Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare, for Pen No. 37 (White Wyandotte), which laid 411 first grade eggs during this period.

The Special Prize of a Silver Medal or (its value, £2) for the *Individual Bird* of non-sitting breed laying the highest number of first grade eggs during the Test has been awarded to Mrs. F. Hanbidge, Blackrath, Ballytore, Co. Kildare, for Pullet No. 511 (Pen No. 92, White Leghorn), which laid 256 first grade eggs.

The Special Prize of a Silver Medal (or its value, £2) for the *Individual Bird* of sitting breed laying the highest number of first grade eggs during the Test has been awarded to Mrs. M. J. Walker, Lower Woodhead, Ballyloughan, Bruckless, Co. Donegal, for Pullet No. 326 (Pen No. 56, Rhode Island Red), which laid 266 first grade eggs.

The Special Prize of a Silver Medal (or its value, £2) for the *Individual Bird* of non-sitting breed laying the highest number of first grade eggs during the period 1st October to 29th December, inclusive, has been awarded to Mrs. M. A. Forster, Tattybrack, Rockcorry, Co. Monaghan, for Pullet No. 723 (Pen No. 101, White Leghorn), which laid 68 first grade eggs during this period.

The Special Prize of a Silver Medal (or its value, £2) for the *Individual Bird* of sitting breed laying the highest number of first grade eggs during the period 1st October to 29th December, inclusive, has been awarded to Mr. G. Barrett, Ring, Clonakilty, Co. Cork, for Pullet No. 593 (Pen No. 88, Light Sussex), which laid 83 first grade eggs during this period.

COPPER RINGS AND SPECIAL CERTIFICATES OF MERIT.

Particulars of 200 pullets which laid 200 first grade eggs or over, and which were awarded Copper Rings and Special Certificates.

TABLE X.

WHITE WYANDOTTE (87 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	First Grade	Second Grade	Total	Name and Address of Owner
1	1	1962	152	53	5	210	Mrs. M. Stanton,
	3	1963	104	98	11	213	Woodlands,
	6	1964	212	4		216	Glanmire,
							Co. Cork.
2	7	1965	210	30	–	240	Mrs. M. E. Strong, Moate House, Ceanannus Mor, Co. Meath.
3	13	1966	55	171	3	229	Miss V. Burdon, The Laurels, Buttevant, Co. Cork.
4							Sister-in-Charge,
	19	1967	142	73	—	215	St. Martha's College,
	20	1968	196	9	1	206	Sion,
	21	1969	121	89	5	215	Navan,
							Co. Meath.
5	26	1970	81	145	10	236	Mrs. M. Mulligan, Paughanstown, Dunleer, Co. Louth.
6	31	1971	209	1	—	210	Mrs. G. Reddy,
	32	1972	221	3	—	224	St. Wolstan's,
	33	1973	187	30	1	218	Celbridge,
	35	1974	228	3	—	231	Co. Kildare.
	36	1975	179	46	1	226	
7	38	1976	24	218	41	283	Miss B. Quain,
	39	1977	172	76	—	248	Anglesboro', Co. Limerick, *via* Mitchelstown.
8	43	1978	113	91	14	218	Mrs. J. Foley, Moyhill House, Cratloe, Co. Clare.
9							Mrs. E. Hillis,
	49	1979	195	5	1	201	Corrush,
	50	1980	168	57	3	228	Doohamlet P.O.,
	51	1981	168	87	1	256	Castleblayney,
	52	1982	192	13	—	205	Co. Monaghan.
	53	1983	215	12	—	227	
12	67	1984	168	37	7	212	Mr. M. Burchael,
	69	1985	174	82	3	259	Kill,
	70	1986	82	160	6	248	Co. Kildare.
	72	1987	197	17	3	217	

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	First Grade	Second Grade	Total	Name and Address of Owner
14	80	1988	117	97	6	220	Mrs. A. M. Murray,
	82	1989	190	48	6	244	Tanderagee,
	83	1990	155	48	4	207	Enfield,
	84	1991	207	4	—	211	Co. Meath.
15	88	1992	38	165	1	204	Miss K. Newman,
	89	1993	27	186	29	242	Drinadaly, Trim, Co. Meath.
16	91	1994	84	208	18	260	Mrs. L. P. Cox,
	92	1995	186	46	—	232	Victoria Park,
	93	1996	214	2	—	216	Donnycarney,
	95	1997	174	41	2	217	Dublin.
	96	1998	120	91	10	221	
18	715	1999	189	124	—	268	Miss A. G. Twigg,
	716	2000	55	148	12	215	Greenwood, Malahide, Co. Dublin.
19	104	2001	213	8	1	222	Miss M. O'Brien,
	105	2002	204	13	—	217	Moycarkey,
	107	2003	4	199	86	239	Horse & Jockey, Thurles, Co. Tipperary.
20	110	2004	83	162	5	250	Mrs. J. Fahy,
	112	2005	216	2	—	218	Corbally, Ballyglunin, Co. Galway.
21	117	2006	232	22	1	255	Mrs. J. Carleton,
	118	2007	200	4	—	204	Drumborisk, Drum, Newbliss, Co. Monaghan.
22	122	2008	159	86	3	248	Mr. W. Barron,
	125	2009	60	161	17	238	Woodview, Gortrush, Piltown, Co. Kilkenny.
23	127	2010	110	97	5	212	Mr. L. Hally,
	131	2011	175	37	5	217	The Cottage, Kells, Thomastown, Co. Kilkenny.
24	133	2012	212	53	—	265	Mrs. M. O. Roberts,
	138	2013	161	63	5	229	Lakemount, Glanmire, Co. Cork.
25	144	2014	85	147	9	241	Mrs. M. L. O'Gorman, Ballinamona, Mitchelstown, Co. Cork.
26	150	2015	75	152	15	242	Miss M. O'Keeffe, Ballybooden, Knocktopher, Co. Kilkenny.

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
27	151 152	2016 2017	216 178	8 80	— 1	224 209	Mrs. E. Condron, Knocktemple, Virginia, Co. Cavan.
29	163 165 166	2018 2019 2020	93 77 78	146 165 180	15 8 22	254 250 280	Mrs. M. Connolly, Carrigamore, Corvalley P.O., Dundalk, (Co. Monaghan.)
30	174	2021	167	48	5	220	Mrs. J. Foley, Moyhill House, Cratloe, Co. Clare.
31	265 268 269	2022 2023 2024	86 206 42	133 10 177	4 — 11	223 216 230	Mrs. K. O'Driscoll, Lisloose, Tralee, Co. Kerry.
33	189 191	2025 2026	75 200	158 6	7 -	240 206	Miss M. Mulcahy, Abbeyview, Clonmel, (Co. Waterford).
34	193 195 198	2027 2028 2029	146 167 206	62 67 41	3 - 5	211 234 252	Mrs. B. Martin, Corglass, Kingscourt, Co. Cavan.
35	201 204	2030 2031	7 118	214 88	19 5	240 211	Mrs. A. B. Barbour, Knockbeg House, Collooney, Co. Sligo.
36	205 208 209 210	2032 2033 2034 2035	159 219 194 176	71 22 17 70	--	230 241 211 246	Mr. M. Burchael, Kill, Co. Kildare.
37	212 213 214 215 216	2036 2037 2038 2039 2040	193 187 214 97 201	28 32 23 164 39	-- — — 2 -	221 219 237 263 240	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.
39	223 224 226 227	2041 2042 2043 2044	47 46 31 192	162 173 210 21	18 21 7 1	227 240 248 214	Miss K. Newman, Drinadaly, Trim, Co. Meath.
40	233	2045	205	24	1	230	Mrs. R. B. Eadie, The Poplars, Beaufort, Co. Kerry.
42	243 244	2046 2047	71 98	139 133	13 5	223 236	Mrs. B. Fallon, Newtown, Termonbarry, (Co. Roscommon).
44	254	2048	65	160	17	242	Mrs. M. Gammons, Ladyrath, Wilkinstown, Navan, Co. Meath.

Rhode Island Red (61 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
46	350 352 353 354	2049 2050 2051 2052	149 16 100 234	51 189 110 13	2 32 3 —	202 237 213 247	Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.
47	274 276	2053 2054	37 132	189 84	40 1	266 217	Miss D. Strong, Moate House, Ceanannus Mór, Co. Meath.
48	281 282	2055 2056	131 130	83 81	1 16	215 227	Miss V. Burdon, The Laurels, Buttevant, Co. Cork.
49	283 284 288	2057 2058 2059	77 107 217	136 116 8	18 4 —	231 227 225	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
50	291	2060	12	222	8	242	Mrs. M. Irwin, Glencarrig, Delgany, Co. Wicklow.
51	296 299	2061 2062	7 166	201 55	27 3	235 224	Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.
53	307 310 312	2063 2064 2065	113 22 23	93 190 230	10 10 14	216 222 267	Capt. H.M.S. Redmond, Popefield, Athy. (Laoighis).
54	313 314 317	2066 2067 2068	27 75 97	187 158 122	18 8 2	232 241 221	Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.
55	323 324	2069 2070	17 133	189 118	13 5	219 251	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.
56	326	2071	141	125	6	272	Mrs. M. J. Walker, Lower Woodhead, Ballyloughan, Bruckless P.O., Co. Donegal.
58	337 339 341	2072 2073 2074	133 183 54	77 20 168	8 1 4	218 204 226	Mrs. M. A. Miller, Millview, Lenamore, Rathowen, (Co. Longford).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Total	Name and Address of Owner
59	344	2075	91	114	8	213	Miss A. M. Dempster, Emo Park, Portarlington, Laoighis.
60	727	2076	219	3	-	222	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.
61	737	2077	69	139	6	214	Mrs. S. Kelly, Pollerton, Carlow.
62	365	2078	61	143	13	217	Miss B. Buckley, Ballyogaha Ballincurrig, Midleton, Co. Cork.
68	369	2079	153	110		263	Mrs. S. Kelly, Pollerton, Carlow.
65	379	2080	195	20	--	215	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford
	381	2081	219	6	--	225	
	383	2082	162	63	2	227	
	384	2083	224	4	—	228	
66	385	2084	95	105	4	204	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.
	389	2085	201	5	—	206	
	390	2086	195	13	—	208	
68	401	2087	24	228	12	264	Mrs. A. Ferguson, Cloghboley, Sligo.
	402	2088	228	4	--	232	
69	405	2089	119	108	8	235	Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.
70	409	2090	97	116	8	221	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.
	411	2091	73	167	6	246	
	412	2092	125	93	1	219	
	413	2093	91	121	1	213	
	414	2094	24	178	35	237	
71	416	2095	188	18	—	206	Mrs. M. Cruite, Tulla, Three Castles, Co. Kilkenny.
	418	2096	179	63	2	244	

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
72	423	2097	86	129	2	217	Miss K. Cannon, Ballyedmonduff, Sandyford, Co. Dublin.
73	427	2098	149	56	—	205	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.
	428	2099	13	224	36	273	
74	433	2100	217	13	—	230	Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.
	434	2101	186	15	—	201	
	435	2102	23	196	37	256	
75	457	2103	93	149	5	247	Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo.
	459	2104	235	8	—	243	
	460	2105	126	93	3	222	
	461	2106	201	43	—	244	
76	448	2107	55	181	25	261	Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.
77	455	2108	145	84	1	230	Mrs. C. Healy, Bweeng P.O., Mallow, Co. Cork.
78	358	2109	140	73	—	213	Mr. R. Burke, Toghermore P.F., Tuam, Co. Galway.

White Leghorn (29 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
85	471	1755	42	169	23	234	Mrs. A. M. Nelson, Derry, Shercock, Co. Cavan.
	473	1756	42	194	31	267	
86	475	1757	107	129	9	245	Miss K. Cunningham, Monreade P.F., Naas, Co. Kildare.
	477	1758	207	9	1	217	
	478	1759	232	22	2	256	
	480	1760	159	80	2	241	
87	485	1761	166	44	—	210	Sister-in-Charge, R.D.E., School, Swinford, Co. Mayo.
88	488	1762	189	83	6	228	Mrs. M. Hanly, Cooga, Doon, Co. Limerick.
	490	1763	126	121	3	250	
	491	1764	22	194	28	244	

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Second Grade	Total	
89	494	1765	41	184	35	260	Mr. R. Finnegan, Stoneyford, Thomastown, Co. Kilkenny.
90	504	1766	125	107	2	234	Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.
91	532	1767	44	168	5	217	Miss A. M. Dempster, Emo Park, Portarlington, Laoighis.
92	511 513 515 516	1768 1769 1770 1771	158 128 50 178	98 112 174 59	2 2 34 1	258 242 258 233	Mrs. F. Hanbidge, Blackrath, Ballytore, Co. Kildare.
94	523 525 528	1772 1773 1774	81 57 44	187 160 176	17 17 6	285 234 226	Mrs. M. A. Walsh, Wardstown, Athboy, Co. Meath.
95	507 510	1775 1776	180 202	41 31	— —	221 233	Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.
97	545	1777	142	61	7	210	Rev. Bro. F. Bergin, Our Lady of Lourdes, Cahermoyle, Ardagh, Co. Limerick.
98	547	1778	189	19	4	212	Mr. T. Burke, Santry Hall, Santry, Co. Dublin.
99	554 556	1779 1780	191 47	42 186	6 11	239 244	Miss E. M. O'Keeffe, St. Rita's, Lakevale, Ballydesmond, Co. Cork.
101	723 725 726	1781 1782 1783	161 196 104	65 27 118	4 — 2	230 223 224	Mrs. M. A. Forster, Tattybrack, Rockcorry, Co. Monaghan.

LIGHT SUSSEX (15 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
80	575	2110	145	86	1	232	Miss E. Walsh, Ballylemon Lodge, Cappagh, Co. Waterford.
81	582	2111	118	92	2	212	Sister-in-Charge, St. Martha's College, Sion, Navan, Co. Meath
82	585	2112	192	25	1	218	Mrs. L. Hastings, Friarstown House, Limerick.
83	593	2113	173	74	1	248	Mr. G. Barrett, Ring, Clonakilty, Co. Cork.
84	610 611 612	2114 2115 2116	156 17 199	68 184 15	3 15 1	227 216 215	Sister-in-Charge, Coolarne College, Athenry, Co. Galway.
103	613 618	2118 2119	30 88	179 113	28 5	237 206	Mrs. J. Hely-Hutchinson, Lissen Hall, Swords, Co. Dublin.
105	625	2120	81	133	8	222	Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.
107	637 638	2121 2122	109 167	108 65	14 2	231 234	Miss D. M. Place, Rosemount, New Ross, Co. Wexford.
108	646	2123	156	53	2	211	Mrs. K. O'Brien, Ballykilmurray, Tullamore, Offaly.
110	656 660	2124 2125	195 52	23 181	1 15	210 248	Mrs. M. Roche, Talbot Hall, New Ross, Co. Wexford.

Barred Rock (5 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
114	662	2126	12	201	22	235	Mrs. L. O'Reilly, Rodstown, Balrath, Ceanannus M'r, Co. Meath.
115	686	2127	78	130	5	213	Mrs. M. A. Kelly, Carranstown, Ballivor, Co. Meath.
	690	2128	27	214	8	249	
116	694	2129	72	136	3	211	Mrs. N. Browne, Burrane, Knock, Co. Clare.
	696	2130	138	78	1	217	

Buff Rock (3 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
117	707	2131	102	125	11	238	Mrs. M. A. Walshe, Tullamore, Listowel, Co. Kerry.
118	709	2132	201	9	—	210	Mrs. E. Walsh, Jordanstown, Buttevant, Co. Cork.
	713	2133	209	3	—	212	

CERTIFICATES OF MERIT.

Particulars of pullets which laid 200 first grade eggs and over, and which were awarded Special Certificates are shown in Table X.

Pullets which laid 170 but less than 200 first grade eggs and which were awarded Certificates are shown in the following table.

Table XI

White Wyandotte.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total
Mrs. M. Stanton, Woodlands, Glanmire, Co. Cork.	1	2 5	183 176	11 38	194 214
Mrs. M. E. Strong, Moate House, Ceanannus Mór, Co. Meath.	2	12	179	—	179
Miss V. Burdon, The Laurels, Buttevant, Co. Cork.	3	14	170	17	187
Sister-in-Charge, St. Martha's College, Sion, Navan, Co. Meath.	4	22 23	173 193	1 14	174 207
Miss B. Quain, Anglesboro', Co. Limerick, *via* Mitchelstown.	7	40 41	194 198	1 6	195 204
Mrs. J. Foley, Moyhill House, Cratloe, Co. Clare.	8	44	184	2	186
Mr. M. Burchael, Kill, Co. Kildare.	12	68	197	—	197
Mrs. J. R. Boyd, The Rectory, Killaloe, Co. Clare.	13	73 74 76	172 180 195	5 — —	177 180 195
Mrs. A. M. Murray, Tanderagee, Enfield, Co. Meath.	14	79	173	36	209

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Miss K. Newman, Drinadaly, Trim, Co. Meath.	15	90	191	4	195
Mrs. L. P. Cox, Victoria Park, Donnycarney, Dublin.	16	94	174	3	177
Mr. W. Frazer, Twigs Park, Manorhamilton, Co. Leitrim.	17	99	191	2	193
Miss A. G. Twigg, Greenwood, Malahide, Co, Dublin.	18	718 720	182 174	7 —	189 174
Miss M. O'Brien, Moycarkey, Horse and Jockey, Thurles, Co. Tipperary.	19	103	183	1	184
Mrs. J. Fahy, Corbally, Ballyglunin, Co. Galway.	20	109 111 113	178 180 188	1 12 —	179 192 188
Mrs. J. Carleton, Drumborisk, Drum, Newbliss, Co. Monaghan.	21	115 120	191 176	10 1	201 177
Mr. W. Barron, Woodview, Gortrush, Piltown, Co. Kilkenny.	22	121	190	34	224
Mr. L. Hally, The Cottage, Kells, Thomastown, Co. Kilkenny.	23	128 130 132	192 197 187	4 — 7	196 197 194
Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.	24	134	195	1	196
Mrs. M. L. O'Gorman, Ballinamona, Mitchelstown, Co. Cork.	25	139 142	182 180	13 31	195 211
Miss M. O'Keeffe, Ballybooden, Knocktopher, Co. Kilkenny.	26	145 148	184 183	— 3	184 186
Mrs. E. Condron, Knocktemple, Virginia, Co. Cavan.	27	153 155	198 187	6 —	204 187
Mrs. M. Mulligan, Paughanstown, Dunleer, Co. Louth.	28	158 159 162	192 188 186	10 7 23	202 195 209
Mrs. K. O'Driscoll, Lisloose, Tralee, Co. Kerry.	31	267	196	5	201

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. A. B. Barbour, Knockbeg House, Collooney, Co. Sligo.	35	199 200	189 180	36 —	225 180
Mr. M. Burchael, Kill, Co. Kildare.	36	207	195	—	195
Miss J. McDermott, Ballyhack, Ashbourne, Co. Meath.	38	222	184	11	195
Miss K. Newman, Drinadaly, Trim, Co. Meath.	39	228	181	1	182
Mrs. B. Fallon, Newtown, Termonbarry, (Co. Roscommon).	42	241	180	12	192
Mrs. E. Hannigan, Caprey, Ballybofey, Co. Donegal.	43	247 251 252	191 177 197	21 — 5	212 177 202
Mrs. M. Drohan, Ballynevin, Carrick-on-Suir, Co. Waterford.	45	263	170	7	177

Rhode Island Red.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Miss D. Strong, Moate House, Ceanannus Mór, Co. Meath.	47	271 272	198 180	5 16	203 196
Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	51	295 300	172 195	3 6	175 201
Mrs. K. Earl, Grantstown House, Waterford.	52	302 303 306	177 187 175	2 12 3	179 199 178
Capt. H. M. S. Redmond, Popefield, Athy, (Laoighis).	53	308 309	196 197	1 3	197 200
Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	55	320	193	1	194
Mrs. M. J. Walker, Lower Woodhead, Ballyloughan, Bruckless P.O., Co. Donegal.	56	325	181	32	213
Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.	57	334 336	194 178	24 —	218 178

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid: First Grade	Eggs Laid: Second Grade	Total
Mrs. M. A. Miller. Millview, Lenamore, Rathowen, (Co. Longford).	58	340	197	--	197
		342	198	32	230
Miss A. M Dempster, Emo Park, Portarlington, Laoighis.	59	343	191	—	191
		347	190	--	190
Miss C. Mealiff. Ballinamona House, Tullamore, Offaly.	60	728	184	8	187
		730	184	44	228
		731	182	4	186
Miss B. Buckley, Ballyogaha, Ballincurrig, Midleton, Co Cork.	62	363	180	5	185
		364	173	1	174
Mrs. S. Kelly, Pollerton, Carlow.	63	372	180	16	196
Mrs. H. Langrell, Killinure House, Tullow, (Co. Wicklow).	64	373	189		189
		374	181	1	182
		375	194	-	194
		376	179	2	181
		377	176	6	182
		378	188	1	189
Miss. M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	65	380	197	12	209
Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick	66	386	170	—	170
		387	171	--	171
		388	176	2	178
Mrs M. Kieran, Dowdstown, Ardee, Co. Louth.	67	392	196	6	202
		394	198	1	199
Mrs. A. Ferguson. Cloghboley, Sligo.	68	399	188	7	195
Mrs. E. O'Donnell. Kilbreedy West. Kilmallock, Co. Limerick.	69	406	193	6	199
Miss K. Cannon, Ballyedmonduff, Sandyford, Co. Dublin.	72	426	190	7	197
Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	73	431	197	2	199

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total
Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.	74	438	199	—	199
Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo.	75	458 462	177 170	6 —	183 170
Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.	76	446	185	5	190
Mrs. C. Healy, Bweeng P.O., Mallow, Co. Cork.	77	452 456	181 180	— 25	181 205

White Leghorn.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total
Mrs. A. M. Nelson, Derry, Shercock, Co. Cavan.	85	469 470 472	174 185 191	12 19 —	186 204 191
Miss K. Cunningham, Monreade, P.F., Naas, Co. Kildare.	86	476 479	189 198	7 21	196 219
Sister-in-Charge, R.D.E. School, Swinford, Co. Mayo.	87	483	172	9	181
Mrs. M. Hanly, Cooga, Doon, Co. Limerick.	88	487	175	—	175
Mr. R. Finnegan, Stoneyford, Thomastown, Co. Kilkenny.	89	495	177	26	203
Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	90	500 503	186 190	— 14	186 204
Miss A. M. Dempster, Emo Park, Portarlington, Laoighis.	91	529 530 531	175 199 195	8 2 5	183 201 200
Mrs. L. Burke, Santry Hall, Santry, Co. Dublin.	93	519	179	21	200

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	95	506 509	186 195	19 12	205 207
Mrs. M. E. Higgins, Carramarla, Claremorris, Co. Mayo.	96	535 536	176 198	— 19	176 217
Rev. Bro. F. Bergin, Our Lady of Lourdes, Cahermoyle, Ardagh, Co. Limerick.	97	541	179	16	195
Mr. T. Burke, Santry Hall, Santry, Co. Dublin.	98	551	172	3	175
Mrs. M. A. Forster, Tattybrack, Rockcorry, Co. Monaghan.	101	722	191	45	236
Mrs. M. E. Shanley, Dromard, Dromod, Co. Leitrim.	102	561	184	8	192

Light Sussex.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. M. Riordan, Glenleigh, Clogheen, Co. Tipperary.	79	567	186	12	198
Miss E. Walsh, Ballylemon Lodge, Cappagh, Co. Waterford.	80	571 573	192 176	— 13	192 189
Mr. G. Barrett, Ring, Clonakilty, Co. Cork.	83	591	172	5	177
Mrs. J. Hely-Hutchinson, Lissen Hall, Swords, Co. Dublin.	103	614 617	173 170	1 1	174 171

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total
Mrs. M. Keatley, Boakfield, Ballytore, Co. Kildare.	104	623	172	6	178
Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.	105	628	187	—	187
Miss U. Roche, Creevaghbeg, Ballymahon, Co. Longford.	106	631	172	12	184
Miss D. M. Place Rosemount, New Ross, Co. Wexford.	107	639	192	—	192
Mrs. K. O'Brien, Ballykilmurray, Tullamore, Offaly.	108	643	187	1	188
Miss M. Johnson, Sea View, Murrintown, Co. Wexford.	109	653	190	18	208
Mrs. M. Roche, Talbot Hall, New Ross, Co. Wexford.	110	655	176	43	219
Miss P. White, Gortnafluir, Clonmel, Co. Tipperary.	111	606	175	12	187

Barred Rock.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total
Mrs. J. N. Edwards, Hillsboro House, Ramelton, Co. Donegal.	112	670	176	–	176
Mrs. L. O'Reilly, Rodstown, Balrath, Ceanannus Mór, Co. Meath.	114	661 663	199 196	22 36	221 232
Mrs M. A. Kelly, Carranstown, Ballivor, Co. Meath.	115	687	175	14	189
Mrs. N. Browne, Burrane Lower, Knock, Co. Clare.	116	691	172	33	205

Buff Rock.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total
Mrs. M. A. Walshe, Tullamore, Listowel, Co. Kerry.	117	708	171	26	197
Mrs. E. Walsh, Jordanstown, Buttevant, Co. Cork.	118	712 714	191 187	— —	191 187

Table XII.

Number and percentage of Pullets of each Breed which qualified for Certificates of Merit.

Breed	Number of Pullets for full Period	Number of Certificates Awarded	Percentage of Pullets awarded Certificates	Percentage Distribution Special Certificates	Percentage Distribution Certificates
			%	%	%
White Wyandotte ..	247	137	55.5	35.2	20.3
Rhode Island Red ...	189	106	56.1	32.3	23.8
White Leghorn ...	92	51	55.4	31.5	23.9
Light Sussex ..	87	29	33.3	17.2	16.1
Barred Rock ..	26	10	38.5	19.3	19.2
Buff Rock	10	6	60.0	30.0	30.0
Ancona	6	—	—	—	—
All Breeds ...	657	339	51.6	30.4	21.2

Table XIII.

Results of post-mortem examinations performed by the Veterinary College on pullets that died.

Date of Death	Number of Pullet	Number of Pen	Breed	Result of Post mortem Examination
1938				
Oct. 3	711	118	Buff Rock	Leukaemia.
„ 5	116	21	White Wyandotte	Peritonitis and oviductitis.
„ 7	636	106	Light Sussex	Multiple tumours.
„ 8	422	72	Rhode Island Red	Visceral gout.
„ 11	675	113	Barred Rock	Gout, and slight infestation of tape worms and threadworms.
„ 17	206	36	White Wyandotte	Impaction of the gizzard.
„ 18	557	99	White Leghorn	Peritonitis and haemorrhage following rupture of the vent. Also tapeworm infestation.
Nov. 4	287	49	Rhode Island Red	Peritonitis, oviductitis and gout.
„ 8	102	17	White Wyandotte	Lymphomatosis of the ovary and mesentery. Also tapeworm infestation.
„ 9	18	3	White Wyandotte	Peritonitis and oviductitis.
„ 28	9	2	White Wyandotte	Peritonitis and oviductitis.
Dec. 5	359	78	Rhode Island Red	Coccidiosis, tapeworm infestation and iritis of both eyes.
„ 9	527	94	White Leghorn	Leukaemia and chronic peritonitis.
„ 10	285	49	Rhode Island Red	Peritonitis and oviductitis.
„ 12	63	11	White Wyandotte	Duodenal coccidiosis.
„ 12	45	8	White Wyandotte	A hernia.
„ 28	171	30	White Wyandotte	Peritonitis and oviductitis
1939				
Jan. 7	397	68	Rhode Island Red	Chronic Peritonitis..
„ 12	496	89	White Leghorn	Coccidiosis and gross tapeworm infestation.
Feb. 1	65	11	White Wyandotte	Tapeworm infestation.
„ 2	101	17	White Wyandotte	Arthritis of left hip joint.
„ 6	695	116	Barred Rock	Anaemia and jaundice.
„ 15	693	116	Barred Rock	Peritonitis due to inflammation of the oviduct.
Mar. 3	360	78	Rhode Island Red	Tuberculosis.
April 17	543	97	White Leghorn	Protrusion of intestine through ruptured vent.
„ 21	560	102	White Leghorn	Congestion of the lungs.
„ 24	609	84	Light Sussex	Blood tumours in the skin (Haemangiomata).
„ 28	357	78	Rhode Island Red	Leukaemia.
May 8	11	2	White Wyandotte	Peritonitis.
June 6	421	72	Rhode Island Red	Peritonitis.
„ 6	667	112	Barred Rock	Tumours (Sarcomata).
„ 7	61	11	White Wyandotte	Lymphomatosis of the ovary.
„ 8	97	17	White Wyandotte	Lymphomatosis of the viscerae.
„ 12	318	54	Rhode Island Red	Blood tumours (Haemangiomata).
„ 24	169	30	White Wyandotte	Peritonitis and oviductitis
„ 26	47	8	White Wyandotte	Oviductitis and peritonitis.
„ 28	524	94	White Leghorn	Acute peritonitis.

Date of Death	Number of Pullet	Number of Pen	Breed	Result of Post-mortem Examination
1939				
July 3	185	32	White Wyandotte	Peritonitis.
,, 5	188	33	White Wyandotte	Peritonitis and oviductitis
,, 7	553	99	White Leghorn	Neuro-lymphomatosis of the eyes.
,, 12	239	41	White Wyandotte	Peritonitis.
,, 18	474	85	White Leghorn	Tuberculosis.
,, 18	544	97	White Leghorn	Prolapse of the intestines.
,, 26	537	96	White Leghorn	Peritonitis.
,, 27	182	32	White Wyandotte	Tapeworm infestation.
Aug. 7	34	6	White Wyandotte	Jaundice following cirrhosis of the liver.
,, 8	225	39	White Wyandotte	Prolapse of the bowel.
,, 10	586	82	Light Sussex	Peritonitis.
,, 11	203	35	White Wyandotte	Peritonitis
,, 11	186	32	White Wyandotte	Tapeworm infestation and obstruction of the bowel.
,, 17	710	118	Buff Rock	Peritonitis.

Table XIV.

Number and Percentage of Deaths for each Breed.

Breed	Number of Pullets Penned	Number of Deaths	Percentage of Deaths
			%
White Wyandotte	270	23	8.5
Rhode Island Red	198	9	4.5
White Leghorn	102	10	9.8
Light Sussex	90	3	3.3
Barred Rock .	30	4	13.3
Buff Rock . .	12	2	16.7
Ancona	6	—	—
All Breeds	708	51	7.2

SECTION I.—WHITE WYANDOTTE.—18 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb.	Weight: On Arrival oz.	Weight: At close of test lb.	Weight: At close of test oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug 5–Aug. 18.	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1 Dec. 29	Value per Pullet s	d	Average Weight of Eggs per Pullet oz.	dr	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen. (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
1	12	Mr. M. Burchael,	1938 Mar 2	67	5	8	6	0	22	1	17	24	21	22	24	26	11	24	12	8	168	37	7	212	39	25	4½	2	5	(a) 1,413	1	3	Nov. July.
		Kill,	,,	68	5	8	6	4	9	22	22	20	19	20	21	18	14	10	19	3	194	3	—	197	56	25	5	2	8	lb oz dr.	—	3	July
		Co. Kildare	,,	69	5	2	5	14	13	22	26	24	23	22	24	26	23	23	22	11	174	82	3	259	63	32	7	2	4	(b) 197 7 14	1	—	*July*
			,,	70	5	6	5	11	22	21	23	25	16	12	24	24	22	24	23	12	82	160	6	248	66	31	5	2	3	oz	—	—	*July*
			,,	71	5	8	5	4	23	25	22	23	23	26	25	24	28	21	27	13	10	157	113	280	22	32	9	2	0	(c) 26.8	—	—	*July*
			,,	72	6	0	6	0	13	22	24	20	19	20	22	22	20	15	14	6	197	17	3	217	60	27	9¼	2	6	(d) £8 15 4	—	—	—
2	16	Mrs. L. P. Cox,	1938 Feb 14	91	4	14	5	11	21	23	21	19	18	22	26	27	23	25	23	12	34	208	18	260	63	32	6¼	2	1	(a) 1,323	—	—	*July*
		Victoria Park,	,,	92	5	12	6	12	22	21	18	20	20	17	22	19	21	20	21	11	186	46	—	232	65	29	3¼	2	5	lb oz. dr	—	—	*July*
		Donnycarney,	,,	93	5	8	7	1	20	21	22	19	19	18	19	19	17	20	15	7	214	2	—	216	67	27	9¼	2	10	(b) 180 5 14	—	—	*July*
		Dublin.	,,	94	5	6	5	0	18	20	17	19	18	20	8	17	19	6	15	—	117	57	3	177	57	23	1¼	2	4	oz.	—	2	Aug.
			Feb 25	95	5	4	6	0	22	18	18	18	17	19	18	20	22	19	18	8	174	41	2	217	60	27	3¼	2	5	(c) 27 5	—	—	*July*
			,, 14	96	5	2	6	8	23	22	22	20	18	19	20	20	19	16	15	7	120	91	10	221	63	28	4½	2	3	(d) £8 7 10	—	—	*July*
3	14	Mrs. A. M. Murray,	1938 Feb.	79	5	4	5	15	23	20	21	14	17	18	20	22	17	15	15	7	82	91	36	209	34	26	0	2	2	(a) 1,292	—	—	*July*
		Tanderagee,	,,	80	5	4	5	8	22	17	19	17	17	21	25	23	19	15	17	8	117	97	6	220	56	27	5	2	3	lb oz dr.	—	—	*July*
		Enfield,	Mar	81	4	14	5	8	19	19	17	15	15	17	19	21	17	16	18	8	8	146	47	201	20	24	4½	2	1	(b) 180 7 11	—	—	*July*
		Co. Meath.	,,	82	5	8	6	12	21	22	21	22	22	22	25	23	25	7	24	10	190	48	6	244	62	30	9¾	2	4	oz	—	1	*July*
			Feb.	83	6	2	7	3	19	20	18	17	16	19	19	22	19	18	17	3	155	48	4	207	57	26	1¼	2	4	(c) 26 8	—	—	*July*
			,,	84	5	14	6	9	3	23	23	17	20	20	23	23	21	10	17	11	207	4	—	211	53	26	7½	2	2	(d) £8 1 4½	—	1	July
4	7	Miss B. Quain,	1938 Feb 11	37	5	12	6	0	24	24	23	21	22	22	23	20	20	10	16	13	3	134	101	238	22	28	7	2	0	(a) 1,322	—	1	July, *June*
		Anglesboro',	,,	38	4	14	5	2	26	23	26	24	22	25	27	26	23	24	26	11	24	218	41	283	50	34	9¾	2	1	lb oz dr	—	—	*July*
		Co. Limerick,	,,	39	4	14	6	13	6	24	25	21	22	23	24	25	22	22	22	12	172	76	—	248	60	31	0¾	2	4	(b) 178 12 14	—	—	*July*
		via Mitchelstown	Mar. 9	40	4	9	5	10	—	7	22	21	22	23	24	23	11	25	5	12	183	11	1	195	33	23	6¼	2	6	oz	—	2	Oct ,July,*June*
			,,	41	4	10	5	6	—	21	22	21	19	21	22	20	21	14	16	7	89	109	6	204	42	25	6	2	3	(c) 26.0	—	—	Oct., *July*
			,,	42	4	8	6	1	—	—	13	19	18	19	20	16	15	15	12	7	95	57	2	154	15	17	10½	2	4	(d) £8 1 4½	—	—	Oct , *June*
5	9	Mrs. E. Hillis,	1938 Feb. 1	49	4	14	5	9	22	26	23	22	20	22	18	18	9	11	8	2	195	5	1	201	75	26	11½	2	6	(a) 1,253	—	—	*June*
		Corrush,	,,	50	5	12	6	8	21	22	24	20	21	19	19	20	20	17	17	8	168	57	3	228	68	29	3¾	2	4	lb oz dr.	—	—	July
		Doohamlet P.O.,	,,	51	5	8	6	8	25	23	20	22	21	19	22	27	22	22	22	11	168	87	1	256	72	32	2¾	2	4	(b) 181 8 13	—	—	*July*
		Castleblayney	,,	52	5	14	7	6	20	17	19	16	15	19	22	22	21	22	11	1	192	13	—	205	60	25	10½	2	6	oz	—	—	*July*
		Co. Monaghan.	,,	53	6	2	7	14	18	24	21	24	23	22	22	18	21	9	18	7	215	12	—	227	68	29	4	2	7	(c) 27.8	—	—	June
			,,	54	5	6	5	10	15	—	—	5	24	24	8	15	13	13	13	6	45	84	7	136	15	15	0	2	3	(d) £7 18 8½	—	4	Nov.,Aug.*June*

SECTION I.—WHITE WYANDOTTE—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of test lb. oz.	Eggs Laid: Oct. 1–Oct 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug 5–Aug 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
																								s. d	oz. dr.				
6	1	Mrs M. Stanton,	1938 Mar. 28	1	6 0	7 10	14	21	20	19	16	16	20	20	21	17	17	9	152	53	5	210	53	26 6¼	2 5	(a) 1 254	—	—	July
		Woodlands,	,,	2	6 3	8 2	10	21	18	15	8	16	20	23	20	17	18	8	124	59	11	194	42	24 1½	2 4	lb oz dr	-	—	—
		Glanmire,	,,	3	4 13	5 13	10	23	20	19	19	20	22	18	16	19	17	10	104	98	11	213	46	26 10¼	2 3	(b) 178 7 13	2	—	*July*
		Co Cork	,,	4	5 4	6 12	10	17	16	21	20	21	18	22	20	18	17	7	118	56	33	207	15	24 11	2 3	oz	3	—	*July*
			,,	5	4 14	6 8	4	23	24	21	20	22	22	20	18	17	14	9	107	69	38	214	17	26 6	2 3	(c) 27 1	—	—	*July*
			,,	6	6 8	6 13	12	16	19	19	17	15	22	21	23	21	19	9	212	4	—	216	51	26 8	2 9	(d) £7 15 7½	—	—	*July*
7	4	Sister-in-Charge,	1938 Feb 20	19	6 0	7 5	22	22	22	22	19	22	21	16	18	13	11	7	142	73	—	215	71	28 0¾	2 4	(a) 1 171	—	—	June
		St Martha's College,	,,	20	6 0	6 14	20	22	20	20	19	21	20	15	14	13	15	9	196	9	1	206	65	26 9¼	2 5	lb oz dr	—	—	July
		Sion,	Mar 10	21	5 8	6 2	3	25	28	24	23	23	17	19	18	14	13	8	121	89	5	215	59	27 11¼	2 3	(b) 164 1 1	—	4	Oct, July
		Navan,	,, 5	22	5 8	5 14	14	16	11	16	—	8	21	21	20	19	19	9	162	11	1	174	43	21 4	2 6	oz	—	—	Feb July, *July*
		Co. Meath.	Feb 20	23	5 12	5 6	17	20	20	21	21	21	21	22	13	11	16	4	41	152	14	207	50	26 2¾	2 2	(c) 26 9	—	3	Aug.
			,,	24	5 0	5 0	3	—	—	16	23	24	24	22	14	12	13	3	16	132	6	154	—	16 10	2 2	(d) £7 7 1¾	—	3	Oct.
8	6	Mrs. G Reddy,	1938 Feb.	31	5 10	5 12	26	10	24	22	21	21	27	16	18	5	10	12	209	1	-	210	65	26 9	2 9	(a) 1 169	—	4	July, *June*
		St. Wolstan's,	,,	32	6 8	6 0	22	16	21	21	21	17	24	19	19	20	17	7	221	3	—	224	64	28 4	2 7	lb oz dr	—	—	July
		Celbridge,	,,	33	6 0	7 6	21	21	8	14	20	18	21	22	22	19	23	9	187	30	1	218	49	26 9¼	2 6	(b) 166 4 15	—	—	*July*
		Co Kildare	,,	34	5 0	D	—	—	—	—	—	—	—	—	—	—	D		—	—	—	—	—	—	—	oz	—	—	July
			,,	35	5 8	5 10	20	23	20	20	18	21	22	22	20	16	19	10	228	3	-	231	68	29 4¼	2 6	(c) 28 8	—	—	*July*
			,,	36	5 8	5 13	22	20	18	19	19	20	21	18	21	18	21	9	179	46	1	226	64	28 7¼	2 4	(d) £6 19 10¼	—	—	July, *June*
9	18	Miss A. G. Twigg	1938 Feb	715	5 10	7 0	23	23	22	22	21	22	24	25	24	23	23	11	139	124	—	263	72	33 1¼	2 3	(a) 1,098	-	—	*July*
		Greenwood,		716	5 10	6 4	21	16	17	17	15	20	20	22	21	18	19	9	55	148	12	215	46	26 6	2 2	lb oz dr	—	—	*July*
		Malahide,	Mar	717	6 0	6 15	23	23	22	22	22	22	25	23	17	20	17	10	61	171	14	246	59	31 0¼	2 2	(b) 151 7 9	—	—	*July*
		Co Dublin	,,	718	5 4	6 2	23	22	16	18	9	12	20	17	14	15	17	6	94	88	7	189	58	24 4¼	2 3		—	—	Feb., *July*
			Feb	719	5 4	7 6	11	—	—	—	—	—	—	—	—	—	—	—	10	1	—	11	11	1 8¾	2 3	(c) 26 5	—	—	Nov, June
			,,	720	5 10	5 9	20	19	18	10	—	15	19	21	20	15	11	6	166	8	—	174	62	22 2¼	2 7	(d) £6 18 11½	—	—	July
10	5	Mrs. M. Mulligan,	1938 Mar 13	25	4 14	5 12	9	24	9	23	13	21	16	23	14	14	8	11	23	124	38	185	24	22 7¼	2 1	(a) 1,091	—	6	June
		Paughanstown,	,,	26	4 10	5 13	19	23	25	22	21	23	22	17	25	13	14	12	81	145	10	236	67	30 3¼	2 2	lb oz dr	1	2	June
		Dunleer,	,,	27	5 0	5 2	—	5	18	9	—	21	20	23	12	17	14	10	56	85	8	149	25	17 3¼	2 3	(b) 151 9 5	—	2	Nov, June
		Co Louth	,,	28	4 8	5 1	8	18	16	19	16	19	21	17	—	3	—	—	129	8	—	137	16	18 3¼	2 7	oz	—	—	Oct, June
			,,	29	5 12	7 15	21	16	22	20	21	23	18	17	14	4	14	10	170	29	1	200	62	25 9¼	2 5	(c) 26.7	—	1	June, *June*
			,,	30	4 12	6 0	8	17	20	18	15	17	24	21	11	15	8	10	153	31	—	184	49	23 3¼	2 5	(d) £6 17 6¾	—	2	July, *June*

SECTION I.—WHITE WYANDOTTE—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of test lb. oz.	Eggs Laid Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan 21-Feb 17	Feb. 18-Mar 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
11	13	Mrs. J. R Boyd,	1938 Mar 5	73	5 12	6 4	9	—	14	22	21	25	16	23	16	10	12	9	141	31	5	177	23	20 8¼	2 4	(a) 1,053	—	4	Oct., June
		The Rectory,	,,	74	6 4	6 12	19	15	—	—	13	22	24	26	24	13	15	9	171	9	—	180	34	20 9¼	2 5	lb oz dr	—	—	Jan., *July*
		Killaloe,	,,	75	5 8	6 0	23	20	16	—	16	21	22	23	14	20	21	9	4	126	75	205	12	23 9¼	2 0	(b) 144 14 12	—	1	Jan., June, *June*
		Co. Clare.	,,	76	4 12	6 0	15	20	19	9	—	21	22	21	23	17	20	8	182	13	—	195	57	24 3¼	2 6	oz	—	—	Jan., *July*
			,,	77	5 2	5 8	—	—	9	13	17	16	15	12	5	11	1	—	37	55	7	99	5	11 5¼	2 3	(c) 26 4	—	—	Oct., July, *June*
			Apl. 3	78	4 12	5 0	19	22	20	22	18	18	21	22	8	13	5	9	52	109	36	197	35	25 1	2 2	(d) £6 6 1½	3	2	July
12	15	Miss K. Newman	1938 Feb	85	5 2	6 12	7	13	20	10	—	—	1	2	—	—	—	—	1	22	30	53	19	8 3¼	1 15	(a) 1,036	1	—	Aug., *June*
		Drnadaly	,,	86	5 4	6 4	—	—	18	17	16	19	19	17	20	19	14	—	114	45	—	159	22	18 8¼	2 4	lb oz dr.	—	—	Oct., *June*
		Trim,	,,	87	5 0	5 8	21	13	11	17	15	2	23	24	21	19	12	5	8	151	24	183	28	22 1¼	2 1	(b) 138 0 15	—	—	*July*
		Co Meath	,,	88	5 0	5 12	—	—	16	20	20	21	23	26	24	22	21	11	38	165	1	204	20	23 3	2 2	oz.	—	—	Oct , *July*
			,,	89	5 0	5 12	21	18	22	19	18	22	24	22	23	23	21	9	27	186	29	242	44	29 7¼	2 1	(c) 25 6	1	—	*June*
			,,	90	5 6	6 0	—	5	21	25	22	23	25	20	21	6	18	9	66	125	4	195	31	23 5	2 3	(d) £6 5 4½	—	2	Oct., Aug., *June*
13	10	Miss P. White,	1938 March	55	5 6	6 8	4	22	10	8	3	4	10	19	18	2	17	—	73	39	5	117	35	15 2¼	2 3	(a) 982	—	2	Oct., June
		Gortnafluir,	,,	56	4 8	6 0	—	—	10	22	22	21	25	17	18	14	6	8	88	72	3	163	13	18 7¼	2 4	lb oz dr	—	1	Oct., June
		Clonmel,	,,	57	5 8	6 6	—	—	—	6	24	21	25	16	16	10	3	10	109	21	1	131	—	14 2¼	2 5	(b) 141 7 14	—	3	Oct., June
		Co Tipperary	,,	58	4 14	5 14	7	23	24	23	18	21	22	17	16	9	9	9	147	48	3	198	56	25 8¼	2 4	oz	—	3	Oct., June
			,,	59	5 8	7 14	—	11	22	19	18	20	22	20	22	18	9	7	177	11	—	188	37	23 0¼	2 6	(c) 27 7	—	1	Oct., July, *June*
			,,	60	4 14	5 6	—	—	17	22	20	20	22	22	22	20	16	4	174	11	—	185	22	21 6	2 7	(d) £5 18 3¼	—	1	Oct., *July*
†	3	Miss V Burdon,	1938 Feb 12	13	5 6	6 1	—	10	24	22	18	23	23	27	24	25	22	11	55	171	3	229	37	27 4¼	2 3	(a) 950	—	—	Oct., *July*
		The Laurels,	,,	14	5 14	5 14	22	21	19	21	15	19	17	14	14	7	14	4	62	108	17	187	51	24 4¼	2 2	lb oz dr.	—	—	*June*
		Buttevant	Feb 23	15	5 2	5 12	-	7	21	17	19	18	22	17	12	10	9	6	136	22	—	158	32	19 5¼	2 6	(b) 127 4 2	—	4	Oct , June
		Co Cork	,,	16	5 4	5 12	16	19	9	—	20	20	22	22	12	13	14	7	28	98	48	174	5	20 3¼	2 1	oz	2	—	Jan., June, *June*
			,,	17	5 8	5 10	21	9	15	22	21	23	22	8	11	17	—	—	22	107	40	169	21	20 10¼	2 1	(c) 25 7	—	4	July
			,,	18	4 12	D	24	9D	—	—	—	—	—	—	—	—	—	—	1	22	10	33	23	5 1¼	1 15	(d) £5 17 6¼	—	—	—
†	2	Mrs. M. E. Strong,	1938 Feb. 9	7	5 8	6 8	24	20	17	20	19	21	24	23	18	22	25	7	210	30	—	240	65	30 0¼	2 5	(a) 912	—	—	*July*
		Moate House,	,,	8	4 14	5 10	5	21	5	9	6	11	23	28	27	9	14	9	95	72	—	167	31	20 0¼	2 4	lb oz. dr.	—	1	Dec., July
		Ceanannus Mor,	,,	9	5 12	D	16	19	D	—	—	—	—	—	—	—	—	—	11	20	4	35	31	5 10¼	2 0	(b) 126 2 5	—	—	—
		Co Meath.	Jan. 26	10	5 6	6 4	21	16	1	—	—	4	24	23	12	18	14	7	31	88	21	140	37	16 3¼	2 1	oz.	—	—	Dec., *July*
			Feb. 9	11	5 0	D	20	23	21	21	20	21	19	6D	—	—	—	—	9	107	35	151	39	20 8	2 0	(c) 26 6	—	1	—
			Jan. 26	12	5 5	5 9	21	24	18	19	19	20	14	13	14	9	—	8	167	12	—	179	67	23 11¼	2 7	(d) £5 16 10¼	—	3	June

D. = Dead. †Disqualified under Clause 28 (pen produced less than 960 eggs).

SECTION I.—WHITE WYANDOTTE—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of test lb. oz.	Eggs Laid Oct. 1–Oct 28	Oct 29–Nov 25	Nov. 26–Dec 23	Dec. 21–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar 18–Apl 14	Apl 15–May 12	May 13 June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
†	8	Mrs J Foley	1938 Mar 1[illegible]	43	5 2	8 2	11	24	20	13	5	21	24	25	22	23	21	9	113	91	14	218	48	26 9	2 3	(a) 825	—	—	Jan, *July*
		Moyhill House	„	44	5 8	8 4	-	16	15	—	9	26	26	23	25	17	16	13	170	14	2	186	29	21 8¼	2 6	lb oz dr	—	1	Jan, July
		Cratloe,	„	45	4 14	D	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	-	—	—	(b) 119 14 11	—	—	Oct
		Co Clare	„	46	5 4	7 3	4	20	20	—	—	21	24	14	13	17	17	8	142	16	—	158	44	19 8¼	2 7	oz	2	—	Jan *July*
			„	47	4 11	D	5	18	20	17	18	18	23	12	—	D	—	-	108	22	1	131	45	17 9	2 4	(c) 27 9	—	—	Oct, *June*
			„	48	5 2	7 8			4	8	11	23	19	19	14	13	14	7	120	12	-	132	8	14 3¼	2 5	(d) £5 0 2¼	—	—	Oct, *July*
†	17	Mr W Fraser,	1938 Jan 23	57	4 14	D	23	24	19	17	10	8	18	17	20			-	29	95	14	138	60	19 3¼	2 1	(a) 729	—	—	—
		Twigs Park,	Feb 8	58	4 13	4 5	22	19	20	16	12	18	21	17	10	15	8	-	132	46	-	178	64	23 4¼	2 4	lb oz d.	1	1	June
		Manorhamilton,	Jan 31	99	4 12	7 0	23	15	19	17	15	14	18	15	14	19	16	8	143	48	2	193	57	24 7¼	2 5	(b) 100 2 8	—	—	July *June*
		Co Leitrim	Feb 17	100	6 0	6 4	19	18	6	—	—	12	22	7	12	14	12	.	60	60	2	122	42	15 7	2 3	oz	—	1	Dec, July, *June*
			„ 8	101	5 8	D	23	23	20	20	2	—	—		—	—	—	-	10	73	5	88	66	14 5¼	2 1	(c) 26 4	—	.	—
			„ 17	102	4 10	D	10	D	—	—		—	—	—	—	—		—	2	8	-	10	10	1 5¼	2 0	(d) £4 18 9¼	—	—	—
†	11	Mrs M K Veale,	1938 Feb 15	61	5 2	D	—	—	—	20	20	11	22	3	D	—	—	—	6	46	24	76	—	8 7	2 0	(a) 674	8	1	Oct
		Ballynagarse,		62	5 6	6 13	20	20	9	18	14	18	20	22	21	16	19	8	136	65	4	205	49	25 4¼	2 3	lb oz dr	1	—	*June*
		Dunhill,	„	63	4 10	D	—	11	6	—	—	—	—	—	—	—	—	—	8	9	—	17	17	3 2¼	2 2	(b) 96 14 3	—	—	Oct.
		Tramore,	„	64	4 14	5 10	—	—	19	20	16	19	20	16	19	12	9	6	153	3	—	156	24	18 5¼	2 6	oz.	1	4	Oct, June
		Co. Waterford	„	65	4 12	D	—	17	19	2	D	—	—	—	—	—	—	—	17	19	2	38	36	6 10¼	2 2	(c) 27 6	—	—	Oct, Jan
				66	4 14	6 0	-	4	19	20	19	21	23	24	20	12	9	11	178	4	—	182	28	21 7¼	2 7	(d) £4 4 2¼	—	—	Oct, July

D=Dead

† Disqualified under Clause 28 (pen produced less than 960 eggs).

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—27 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of Test lb. oz.	Eggs Laid Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	37	Mrs. K. F. Graham,	1938 Feb	211	6 0	6 0	24	23	19	21	19	19	21	21	18	16	19	8	182	46	—	228	71	20 2¼	2 4	(a) 1,108	—	—	*July*
		Ballagh Lodge,	,,	212	5 12	5 5	22	22	20	20	20	21	25	24	12	16	17	2	193	28	—	221	69	28 3¼	2 5	lb. oz. dr.	—	3	July
		Donadea,	,,	213	6 0	6 14	23	23	21	19	14	21	19	19	17	17	17	9	187	32	—	219	70	28 2¼	2 5	(b) 199 4 8	—	—	*July*
		Co. Kildare.	,,	214	5 12	6 0	19	19	18	19	19	20	24	24	22	24	20	9	214	23	—	237	60	29 5	2 5	oz.	—	—	*July*
			,,	215	5 10	6 4	24	24	20	22	20	24	23	24	24	25	22	11	97	164	2	263	71	32 11¼	2 3	(c) 27 2	—	—	*July*
			,,	216	5 8	5 14	24	21	21	21	18	21	22	23	22	19	19	9	201	39	—	240	70	30 5	2 4	(d) £8 18 6½	—	—	*July*
2	29	Mrs. M. Connolly,	1938 Feb	163	5 8	6 6	23	26	27	26	26	25	25	22	19	16	13	6	93	146	15	254	69	32 8¼	2 3	(a) 1,411	1	—	*July*
		Carrigamore,	,,	164	5 12	6 4	18	11	4	3	17	14	18	21	18	9	19	8	31	99	30	160	4	18 3½	2 2	lb. oz. dr.	—	1	Dec June *June*
		Corvalley P.O.,	,,	165	5 6	6 0	25	22	21	19	19	24	26	26	23	25	7	13	77	165	8	250	69	31 4	2 2	(b) 184 13 1	—	—	*July*
		Dundalk,	,,	166	5 6	6 4	26	26	24	25	23	24	26	26	24	24	21	11	78	180	22	280	62	35 0¾	2 2	oz.	—	—	*July*
		(Co. Monaghan)	,,	167	4 14	6 8	24	25	24	21	21	16	17	17	16	15	12	8	26	101	89	216	8	26 9	2 0	(c) 25 1	5	—	July
			,,	168	5 12	6 12	15	21	21	17	18	19	22	27	27	27	25	12	13	173	65	251	44	29 6¼	2 0	(d) £8 13 8¼	2	—	*July*
3	34	Mrs. B. Martin,	1938 Jan. 8	193	5 3	6 8	25	20	11	25	23	21	24	16	16	11	12	7	146	62	3	211	59	26 10¼	2 4	(a) 1,284	—	5	June
		Corglass,	,,	194	5 2	4 13	24	22	12	23	20	5	20	—	5	—	—	—	13	98	20	131	51	18 4¾	2 1	lb. oz. dr.	3	—	Mar., June, *May*
		Kingscourt,	,,	195	5 4	5 12	26	23	24	23	21	24	25	25	13	19	12	8	167	67	—	234	78	30 4¾	2 4	(b) 181 4 5	—	3	June
		Co. Cavan	,,	196	5 0	6 8	20	25	23	23	21	23	25	26	22	17	18	9	239	13	—	252	73	32 1	2 6	oz.	—	—	*June*
			,,	197	4 14	5 12	22	21	21	19	17	19	21	23	17	21	3	—	156	48	—	204	69	26 5¾	2 4	(c) 27 1	—	—	July
			,,	198	4 12	6 2	25	25	22	22	24	22	27	28	9	27	11	10	206	41	5	252	72	32 1	2 4	(d) £8 6 3¾	—	2	July, *June*
4	39	Miss K. Newman,	1938 Feb.	223	5 0	5 4	—	9	21	23	23	21	26	23	22	22	24	13	47	162	18	227	36	26 8¼	2 2	(a) 1,321	—	—	Oct.
		Drinadaly,	,,	224	4 10	5 10	21	20	19	18	17	21	21	25	24	26	23	11	46	173	21	240	42	29 5	2 2	lb. oz. dr.	—	—	*July*
		Trim,	,,	225	4 14	D	23	21	20	19	19	21	22	22	21	15	7	D	52	154	4	210	64	27 9	2 2	(b) 178 0 9	—	—	*July*
		Co. Meath	,,	226	5 2	6 7	22	22	19	21	20	21	27	23	21	20	21	11	31	210	7	248	63	30 11½	2 2	oz.	—	—	*July*
			,,	227	6 2	7 4	9	21	20	17	17	19	22	21	24	19	17	8	192	21	1	214	53	26 9¾	2 5	(c) 25 9	—	—	*July*
			,,	228	5 8	5 12	21	21	17	18	15	17	20	21	17	15	—	—	92	89	1	182	62	23 9	2 3	(d) £8 4 7¼	—	—	July
5	20	Mrs. J. Fahy,	1938 Feb. 28	109	4 12	6 8	6	19	18	6	—	11	24	24	24	21	18	8	30	145	1	179	46	21 10¼	2 2	(a) 1,301	—	—	Jan., *July*
		Corbally,	Mar. 15	110	4 12	5 12	21	24	18	17	20	20	25	26	24	22	22	11	83	162	5	250	64	31 1¼	2 2	lb. oz. dr.	—	—	*July*
		Ballyglunin,	Feb. 28	111	5 8	5 10	18	21	17	10	3	19	23	23	25	18	6	9	54	126	12	192	51	23 10	2 2	(b) 181 5 13	—	1	July
		Co. Galway.	Mar. 15	112	4 8	6 1	—	16	19	23	21	21	24	23	21	22	17	11	216	2	—	218	40	26 6¼	2 9	oz.	—	—	Oct., *July*
			,,	113	4 12	6 0	—	19	21	13	17	19	22	26	26	21	—	4	149	39	—	188	45	23 4	2 5	(c) 26 8	—	—	Oct., July
			,,	114	4 8	6 0	25	25	24	23	23	26	24	26	23	23	22	10	53	216	5	274	77	34 7½	2 2	(d) £8 1 3¾	—	—	*July*

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of Test lb. oz	Eggs Laid Oct 1-Oct. 28	Oct. 29-Nov 25	Nov. 26-Dec 23	Dec 24-Jan 20	Jan. 21-Feb 17	Feb 18-Mar 17	Mar 18-Apl 14	Apl 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug 4	Aug 5-Aug 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade Oct. 1-Dec. 20	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
*	25	Mrs. M. L. O'Gorman,	1938 Mar 20	139	4 8	5 1	22	22	21	19	17	17	18	18	11	16	5	9	80	102	13	195	55	25 5¼	2 2	(a) 1,313	—	2	May
		Ballinamona,	,,	140	4 12	5 8	21	21	20	19	20	18	21	21	19	20	19	10	1	105	123	229	3	26 5¼	1 15	lb oz dr	—	—	July
		Mitchelstown,	,,	141	4 9	5 3	17	21	19	21	20	18	23	22	19	16	13	7	11	130	75	216	9	25 11½	2 0	(b) 168 11 4	5	—	July
		Co Cork.	,,	142	5 8	7 0	7	21	20	18	19	17	20	19	21	17	22	10	58	122	31	211	25	25 11	2 2	oz	3	—	July
			,,	143	4 14	5 8	23	21	22	21	19	21	22	24	4	19	14	11	7	131	83	221	10	26 3¼	2 0	(c) 24 7	—	2	June
			,,	144	4 14	5 12	25	22	21	20	21	22	21	20	18	21	20	10	85	147	9	241	64	30 5¾	2 2	(d) £8 0 11	1	—	*June*
6	22	Mr. W. Barron,	1938 Feb 4	121	5 8	5 4	24	25	24	22	5	15	21	24	13	20	13	9	14	176	34	224	52	28 5½	2 1	(a) 1,308	—	1	Feb., *July*
		Woodview,	,,	122	5 0	5 10	25	25	24	23	20	22	19	20	22	19	21	5	159	56	3	218	76	31 11¼	2 4	lb oz dr	—	—	*July*
		Gortrush,	,,	123	5 6	6 4	—	—	—	15	23	26	22	16	19	14	11	9	113	40	2	155	—	16 10	2 4	(b) 176 3 2	—	2	Oct., July
		Piltown,	,,	124	5 0	5 8	—	—	3	21	23	25	23	24	9	24	13	12	6	117	54	177	6	18 5	2 0	oz	2	2	Oct., June, *June*
		Co. Kilkenny	,,	125	5 10	6 7	19	25	21	24	22	24	24	23	20	17	8	11	60	161	17	238	55	30 2	2 2	(c) 25 9	1	1	June, *June*
			,,	126	5 0	6 6	20	23	23	20	20	23	26	25	28	22	23	13	112	153	1	266	68	33 2¼	2 3	(d) £7 19 0½	—	—	*July*
*	44	Mrs. M. Gammons,	1938 Mar 10	253	4 9	5 10	—	12	18	18	15	18	19	24	21	21	19	9	4	137	53	194	18	22 2¼	2 0	(a) 1,349	—	—	Oct., *July*
		Ladyrath,	,,	254	5 4	6 2	19	21	22	21	21	20	23	23	22	23	18	9	65	160	17	242	51	30 2¼	2 2	lb oz dr	—	—	*July*
		Wilkinstown,	,,	255	4 8	5 0	14	28	26	23	24	24	27	26	24	25	23	12	1	119	156	276	3	31 7¼	1 15	(b) 173 5 7	—	—	*July*
		Navan,	,,	256	4 12	5 4	16	20	15	19	17	16	21	23	21	18	20	10	5	159	52	216	12	25 10¼	2 0	oz	1	—	*July*
		Co Meath	,,	257	4 8	5 10	12	22	21	19	18	20	21	23	21	22	24	9	3	126	103	232	4	26 11	1 15	(c) 24 7	2	—	*July*
			,,	258	5 0	5 12	—	—	15	21	25	21	26	25	22	21	11	2	167	20	2	189	20	21 8¼	2 5	(d) £7 18 7	—	1	Oct., Aug.
7	33	Miss M Mulcahy	1938 Feb. 10	187	5 2	5 12	22	25	22	21	16	22	27	27	26	27	27	12	5	202	67	274	60	32 9¼	2 0	(a) 1,224	—		June
		Abbeyview,	Feb	188	6 2	D	4	—	19	22	23	23	27	25	22	D	—	—	155	10	—	165	28	19 9¼	2 7	lb oz dr	—	—	Oct., June
		Clonmel,	Feb. 10	189	6 2	7 0	25	27	25	23	19	24	25	21	19	8	13	11	75	158	7	240	77	31 2	2 2	(b) 170 7 5	—	2	June
		(Co Waterford)	Feb	190	4 10	5 4	19	18	20	19	16	15	18	14	11	10	9	2	119	51	1	171	60	22 6¼	2 4	oz	—	—	*June*
			Feb.	191	5 10	5 15	9	19	16	12	11	20	22	25	23	18	21	10	200	6	—	206	48	25 1¼	2 7	(c) 26 7	—	—	*July*
			Feb 28	192	5 14	5 12	—	9	23	23	23	24	25	24	12	5	—	—	96	71	1	168	35	21 0¼	2 4	(d) £7 12 5½	—	—	Oct
8	45	Mrs. M. Drohan,	1938 Feb. 21	259	6 3	5 4	22	20	20	18	12	20	25	21	9	20	—	8	171	24	—	195	66	25 2¼	2 4	(a) 1,229	—	2	June
		Ballynevin,	,,	260	5 0	5 4	18	16	23	7	23	26	5	21	13	12	19	5	5	129	54	188	23	22 10½	2 0	lb oz dr	—	5	June
		Carrick-on-Suir,	,,	261	5 6	5 8	20	16	—	19	19	21	22	21	21	20	20	10	134	75	—	209	40	24 11	2 4	(b) 167 8 14	—	—	*June*
		Co. Waterford.	,,	262	5 3	5 9	25	25	23	24	22	22	21	20	21	20	18	5	22	201	23	246	50	31 4½	2 1	oz	—	—	July
			,,	263	5 8	5 12	16	—	—	19	25	25	15	26	16	8	14	13	83	87	7	177	13	19 10½	2 3	(c) 26 2	—	5	Nov., July, *June*
			,,	264	5 12	6 8	21	20	19	17	17	20	23	18	19	9	21	10	196	17	1	214	63	27 1	2 5	(d) £7 11 4	—	2	June

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug 5–Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
			1938																					s. d	oz dr				
9	31	Mrs. K. O'Driscoll,	Feb 17	265	5 0	5 8	21	19	17	18	16	19	23	19	20	21	20	10	86	133	4	223	58	27 9½	2 3	(a) 1,166	—	—	*June*
		Lisloose,	„ 3	266	5 12	5 0	23	23	22	6	—	7	18	15	4	5	5	5	102	30	1	133	72	18 6¾	2 4	lb oz dr	—	1	Jan, June
		Tralee,	„ 3	267	5 6	5 10	—	16	22	24	24	25	23	17	11	13	19	7	45	151	5	201	43	25 1¾	2 2	(b) 161 11 10	—	5	Aug., *June*
		Co. Kerry.	„ 17	268	5 10	6 4	22	18	19	17	19	20	20	22	18	18	15	8	206	10	—	216	64	27 3½	2 7	oz	—	—	*June*
			„ 3	269	4 14	5 5	22	21	18	19	17	21	21	21	22	18	21	9	42	177	11	230	56	28 8¾	2 2	(c) 26.6	—	—	*June*
			„ 3	270	5 6	5 8	17	20	18	18	9	14	12	15	14	10	7	9	138	24	1	163	59	21 5½	2 5	(d) £7 8 11¼	—	3	June, *June*
			1938																										
10	24	Mrs M O Roberts,	Mar. 14	133	6 4	7 2	26	23	27	25	25	22	26	24	22	10	23	12	212	53	—	265	82	34 0¼	2 5	(a) 1,209	—	—	June
		Lakemount,	„	134	5 2	5 0	—	23	27	26	22	23	20	18	10	13	14	—	128	67	1	196	55	25 7¼	2 4	lb oz dr	—	3	Oct., May
		Glanmire	„	135	5 12	6 3	12	3	—	14	5	14	22	24	22	23	22	11	13	136	23	172	3	18 8½	2 1	(b) 166 3 13	2	—	Nov., *July*
		Co Cork	„	136	5 6	5 10	12	23	20	9	—	17	24	21	20	19	21	11	8	138	51	197	33	23 8	2 0	oz.	2	—	Jan, *Feb.*
			„	137	5 12	5 8	—	—	—	13	21	21	23	23	9	22	13	5	54	92	4	150	—	16 2	2 3	(c) 26 4	—	3	Oct., July
			„	138	6 4	6 12	24	25	23	20	18	18	19	21	19	17	17	8	161	63	5	229	72	29 7¾	2 5	(d) £7 7 9¾	—	—	*July*
			1938																										
11	27	Mrs E Condron,	Feb 3	151	5 10	6 14	24	22	20	19	20	20	21	22	16	20	13	7	216	8	-	224	70	28 8½	2 6	(a) 1,166	—	—	July
		Knocktemple,	„	152	4 12	6 8	—	9	25	24	22	24	24	26	14	16	21	4	178	30	1	209	39	25 6	2 5	lb oz dr	—	—	Oct, June
		Virginia,	„	153	4 12	5 6	17	21	21	21	19	21	23	18	15	14	14	—	140	58	6	204	63	26 2½	2 4	(b) 166 0 7	—	3	July
		Co. Cavan.	„	154	4 12	5 2	22	17	19	18	15	18	17	15	8	13	14	—	3	137	36	176	39	22 4¾	2 0	oz	—	4	June
			„	155	5 0	6 2	2	21	21	18	13	19	21	21	16	16	14	5	182	5	—	187	48	23 8¾	2 7	(c) 27.3	—	—	*July*
			„	156	5 0	6 4	—	7	21	16	15	17	19	20	6	21	19	5	132	33	1	166	32	20 1¾	2 4	(d) £7 6 8	—	—	Oct., *July*
			1938																										
12	28	Mrs. M Mulligan,	Mar 4	157	6 10	5 8	7	21	13	11	2	16	18	15	10	—	—		103	12	—	115	45	15 7¾	2 6	(a) 1,163	—	—	May
		Paughanstown.	„	158	5 12	6 13	22	18	19	18	18	18	22	26	—	20	10	11	90	102	10	202	60	25 7	2 3	lb oz. dr.	—	2	June
		Dunleer,	„	159	5 8	7 0	15	20	19	21	18	19	22	23	14	16	8	—	57	131	7	195	52	24 10½	2 3	(b) 161 11 12	—	—	May
		Co Louth	„	160	5 0	6 0	—	3	25	21	23	22	22	21	18	22	22	10	173	31	—	209	32	25 0	2 5	oz	—	—	Oct., *July*
			„	161	5 8	5 15	—	19	26	24	20	19	25	25	24	22	18	11	184	48	1	233	50	28 10¼	2 5	(c) 26 7	—	—	*July*
			„	162	4 8	5 14	12	20	22	19	22	20	21	19	17	16	14	7	67	119	23	209	39	26 2½	2 2	(d) £7 6 2¾	1	—	June, *June*
			1938																										
*	35	Mrs. A. B Barbour,	Feb	199	5 4	5 0	17	19	20	18	16	18	22	21	24	21	20	9	8	181	36	225	52	27 5	2 1	(a) 1,180	—	—	*July*
		Knockbeg House,	„	200	4 14	5 12	21	17	21	17	14	17	15	15	12	14	12	5	172	8	—	180	63	23 6	2 9	lb. oz. dr.	—	—	*July*
		Collooney,	„	201	4 12	5 9	18	22	21	20	18	20	25	25	21	22	16	12	7	214	19	240	61	29 9	2 1	(b) 157 15 12	3	1	July
		Co. Sligo	„	202	5 0	4 10	—	22	24	22	21	22	25	23	20	21	7	—	—	15	192	207	1	22 2¾	1 14	oz	6	1	July
			„	203	5 8	D	2	14	14	6	12	16	20	22	—	4	7	D	90	27	—	117	30	14 9¼	2 4	(c) 25.7	—	—	*June*
			„	204	4 12	5 10	21	22	19	20	16	18	22	20	20	17	10	6	118	88	5	211	61	27 0½	2 3	(d) £7 4 8½	—	—	*July*

D. = Dead. * Disqualified under Clause 28 (more than 20 per cent. second grade eggs).

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival		Weight: At close of test		Eggs Laid: Oct 1-Oct 28	Oct 29-Nov 25	Nov 26-Dec 23	Dec 24-Jan 20	Jan 21-Feb 17	Feb. 18-Mar 17	Mar 18-Apl 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug 4	Aug. 5-Aug 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec 29	Value per Pullet		Average Weight of Eggs per Pullet		(a) Total Eggs from Pen (b) Total weight (c) Av Weight per dozen. (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in Italics)
					lb	oz	lb.	oz																		s	d	oz	dr				
13	19	Miss M. O'Brien,	1938 Jan 28	103	5	0	5	4	16	21	16	17	20	23	20	13	14	10	5	9	113	70	1	184	56	23	10¼	2	3	(a) 1 165	—	4	June
		Moycarkey,	"	104	4	8	5	1	17	24	21	20	22	21	23	23	23	17	11	--	213	8	1	222	65	28	5¾	2	5	lb oz dr	—	—	July, *June*
		Horse and Jockey,	"	105	5	8	6	10	—	—	14	25	25	25	26	24	23	17	25	13	204	13	-	217	20	24	9¼	2	7	(b) 162 2 12	—	1	Oct , Aug
		Thurles	"	106	5	4	5	0	14	17	19	8	-	13	24	10	22	—	17	—	54	88	2	144	54	18	7½	2	3	oz	--	2	Jan , June
		Co Tipperary	"	107	4	10	5	8	-	12	19	23	22	25	26	26	24	25	26	11	4	199	36	239	21	27	7	2	1	(c) 26 7	1	--	Oct., *July*
			"	108	5	4	6	7	-	-	16	22	22	24	11	19	12	8	17	8	78	73	8	159	21	18	7	2	3	(d) £7 1 10¼	—	3	Oct ,July,*June*
14	43	Mrs E Hannigan	1938 Mar 17	247	5	8	6	0	28	21	19	18	16	18	19	17	19	16	14	7	135	56	21	212	51	26	11¼	2	4	(a) 1,142	--	—	July
		Caprry,	"	248	4	12	5	8	25	12	21	21	18	20	22	12	13	20	4	12	16	139	45	200	24	24	9½	2	1	lb oz dr	—	4	June, *June*
		Ballybofey,	"	249	4	14	5	8	16	16	14	3		10	21	16	13	10	8	9	84	52	--	136	49	17	3½	2	3	(b) 153 0 5	--	4	Feb .June,*June*
		Co Donegal	"	250	5	6	5	8	25	19	21	17	1	4	24	25	24	22	22	11	-	138	79	215	25	25	6¼	2	0	oz.	—		Feb
			"	251	5	12	6	15	22	17	9	-	10	15	22	22	20	18	18	4	152	25	—	177	48	21	6¾	2	4	(c) 25 7	--	--	*July*
			"	252	5	0	6	4	22	20	19	15	15	17	20	24	16	14	14	6	75	122	5	202	60	25	8¼	2	3	(d) £7 1 10¼	1	—	July
15	23	Mr L Hally,	1938 February	127	5	4	6	2	17	19	17	16	19	20	22	21	18	18	17	8	110	97	5	212	52	26	5	2	3	(a) 1 141	—	--	*June*
		The Cottage,	"	128	6	0	6	14	17	5	15	19	19	21	22	21	19	7	10	11	171	21	4	196	38	23	8¼	2	7	lb oz dr	—	1	Nov., June
		Kells,	"	129	6	0	6	12	—	—	8	21	9	-	18	24	18	10	10	7	29	90	6	125	12	14	2	2	2	(b) 162 5 8	--	3	Oct , Feb., Aug., *June*
		Thomastown	"	130	5	3	5	4	25	16	20	19	17	19	23	23	7	11	16	1	161	36	-	197	66	25	1¼	2	4	oz	--	2	June
		Co Kilkenny	"	131	4	10	6	2	--	22	22	21	21	23	24	26	20	18	9	11	175	37	5	217	45	26	11¾	2	4	(c) 27 3	—	1	July, *June*
			"	132	4	14	5	4	22	18	18	17	17	18	20	20	17	6	11	7	125	62	7	194	54	24	8¾	2	5	(d) £7 1 4	--	2	June
16	36	Mr M Burchael	1938 Feb 1	205	6	8	7	4	18	19	22	19	15	20	23	19	23	19	23	10	159	71	--	230	65	28	10½	2	4	(a) 1 129	-	---	*June*
		Kill,	Mar 2	206	5	12	D		6	--	—	—	—	—	—	—	—	—	—	—	-	2	4	6	2		9½	1	15	lb oz dr	--	-	—
		Co Kildare	Feb 1	207	6	0	5	8	20	2	6	22	21	24	24	27	21	6	15	7	195		-	195	33	22	9	2	8	(b) 164 7 3	-	1	Nov , *June*
			Mar 2	208	5	12	7	4	-	12	25	23	25	25	26	28	23	22	22	10	219	22	-	241	40	29	1¼	2	5	oz	—	--	Oct , *June*
			"	209	5	12	6	8	21	20	18	19	12	--	21	23	24	23	21	9	194	17	—	211	63	26	9¼	2	6	(c) 28 0	—	--	Feb , *June*
			Feb 1	210	5	12	6	9	25	22	22	20	21	20	21	25	19	21	21	9	176	70	—	246	73	31	2¾	2	4	(d) £6 19 6¼	--	--	*June*
17	38	Miss J McDermott,	1938 Feb 24	217	5	12	6	15	12	—	--	3	16	20	22	23	10	17	19	9	7	122	22	151	1	15	11	2	1	(a) 1,128	—	—	Nov , *July*
		Ballyhack,	Mar 8	218	5	0	5	9	23	28	23	19	18	18	19	23	4	20	9	12	124	86	1	211	72	27	6¾	2	3	lb oz dr	--	2	June
		Ashbourne,	Feb 24	219	4	10	6	0	12	16	19	21	11	14	14	14	13	16	11	10	69	90	12	171	39	21	9¾	2	3	(b) 148 2 1	—	--	*July*
		Co. Meath	"	220	5	0	5	2	20	18	12	23	19	20	17	20	19	15	9	8	10	143	47	200	25	24	2	2	0	oz	—	2	July, *June*
			"	221	4	10	5	8	15	24	21	18	18	13	17	22	17	13	10	12	2	105	93	200	5	24	0¼	1	15	(c) 25 2	4	2	July, *June*
			Mar 8	222	4	10	5	4	16	17	19	18	10	15	20	20	19	19	15	7	105	79	11	195	47	24	5¼	2	3	(d) £6 17 11¼	—	—	*July*

D = Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of test (lb. oz.)	Eggs Laid: Oct. 1 Oct. 28	Oct. 29–Nov 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar 18–Apl. 14	Apl. 15 May 12	May 13 June 9	June 10–July 7	July 8–Aug. 4	Aug 5–Aug 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen. (b) Total weight. (c) Av weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
																								s, d	oz dr				
*	42	Mrs B. Fallon,	1938 Mar 3	241	5 4	6 8	19	18	18	14	11	8	19	21	20	17	18	9	114	66	12	192	45	24 1½	2 3	(a) 1 141	—	—	Feb.
		Newtown,	,,	242	4 8	4 13	21	21	18	17	16	19	20	22	19	2	18	12	1	85	119	205	11	23 8¼	1 15	lb oz dr	2	1	July
		Termonbarry,	,,	243	4 8	5 12	21	21	19	19	20	20	21	20	20	18	16	8	71	139	13	223	55	28 0¾	2 2	(b) 150 3 14	—	—	*June*
		Longford,	,,	244	4 14	5 14	23	22	23	21	18	22	24	27	16	21	8	11	98	133	5	236	67	30 0¾	2 3	oz	—	1	*June*
		Co Roscommon).	,,	245	4 10	5 2	8	19	3	8	6	7	25	11	13	9	17	4	—	43	87	130	—	14 3¼	1 15	(c) 25 3	19	4	Feb., *June*
			,,	246	4 12	6 0	15	—	—	10	21	21	20	23	20	20	5	—	102	50	3	155	12	17 2¼	2 4	(d) £6 17 5¼	—	—	Nov., *June*
*	41	Miss M Tonall,	1938 January	235	5 4	3 14	22	21	13	14	13	19	17	18	9	9	—	—	6	101	48	155	41	19 5¼	2 0	(a) 1,036	—	1	June
		Surgalstown,	Mar 15	236	5 4	5 10	20	22	19	17	16	18	20	24	22	8	21	11	—	85	133	218	1	24 10¾	1 15	lb oz dr	3	1	*July*
		St Margaret's,		237	4 14	[illegible] 4	12	22	9	9	22	22	23	23	22	17	10	—	9	146	36	191	13	22 10¼	2 1	(b) 140 0 7	—	1	Dec, *July*
		Co Dublin.	February	238	5 14	5 6	11	10	11	7	11	20	23	23	24	19	16	—	81	83	11	175	26	20 3½	2 3	oz	—	1	*June*
			,,	239	4 11	D	17	24	19	20	17	21	22	21	20	7	D	—	104	82	2	188	63	24 8¼	2 3	(c) 24 8	1	—	June
			,,	240	4 10	4 10	17	13	16	17	17	18	18	17	12	7	6	2	16	95	48	159	18	19 5	2 0	(d) £6 11 8¼	3	—	*July*
18	26	Miss M. O'Keeffe,	1938 Feb 28	145	4 10	5 6	—	9	21	20	16	19	24	24	23	21	2	5	128	56	—	184	34	22 4	2 4	(a) 1 054	1	1	Oct., July
		Ballybooden,	,,	146	4 12	7 2	-	3	19	16	16	15	21	17	14	16	12	5	109	45	—	154	27	18 6½	2 4	lb oz dr	20	—	Oct., *July*
		Knocktopher,	,,	147	5 4	6 8	24	23	19	20	17	15	16	5	—	—	—	—	63	73	3	139	67	20 0¼	2 3	(b) 144 5 4	—	1	June, *June*
		Co. Kilkenny		148	4 10	6 0	—	4	17	18	19	20	23	21	20	19	18	7	114	69	3	186	22	21 8¾	2 4	oz	—	—	Oct., *July*
			,,	149	4 10	5 1	-	—	—	19	26	26	23	27	—	—	21	7	28	112	9	149	1	16 2¼	2 2	(c) 26 3	2	2	Oct, Aug., *June*
			,,	150	4 11	6 0	20	23	21	21	21	22	22	22	21	19	20	10	75	152	15	242	53	30 4½	2 2	(d) £6 9 2¼	3	—	*July*
19	21	Mrs J. Carleton,	1938 Jan 20	115	4 8	5 0	17	23	22	21	23	21	19	23	13	9	5	5	99	92	10	201	57	26 1¼	2 3	(a) 986	—	3	June
		Drumborisk,	,,	116	5 8	D	20	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	3¼	1 15	lb oz dr	—	—	—
		Drum,	,,	117	5 10	6 9	22	23	21	20	19	20	25	23	21	24	23	11	232	22	1	255	69	32 0½	2 5	(b) 141 6 11	—	—	*July*
		Newbliss,	,,	118	5 3	5 13	15	23	20	20	21	19	19	21	19	14	13	—	200	4	--	204	63	26 4¾	2 7	oz.	—	—	—
		Co. Monaghan	Feb 14	119	5 12	6 8	18	13	—	—	—	19	17	18	22	17	17	6	127	16	4	147	27	17 0	2 5	(c) 27 5	—	—	Nov., *July*
			,,	120	5 6	5 0	10	21	21	19	16	18	22	16	10	5	10	9	139	37	1	177	56	28 2½	2 4	(d) £6 5 0¼	—	2	June
†	40	Mrs. R. B Eadie,	1938 Jan 10	229	5 6	5 4	17	18	19	15	—	8	23	16	17	19	15	4	58	105	13	171	58	21 9½	2 2	(a) 945	—	3	—
		The Poplars,	,,	230	5 4	5 8	19	16	14	18	16	20	22	21	18	19	17	8	192	16	—	208	53	25 8¼	2 6	lb oz dr	—	—	*July*
		Beaufort,	,,	231	5 2	5 0	18	8	16	8	20	13	25	13	13	12	12	6	150	12	2	164	44	20 4¾	2 6	(b) 135 4 15	—	4	Nov., Jan., June
		Co Kerry.	,,	232	5 8	5 8	20	16	—	—	11	27	19	15	9	14	12	4	135	10	2	147	36	17 7¼	2 6	oz	—	3	Dec., June
			,,	233	5 4	5 9	22	16	20	20	21	21	22	22	21	18	20	7	205	24	1	230	61	28 9	2 4	(c) 27 5	—	—	July
			,,	234	5 3	3 0	15	8	—	—	—	—	—	—	—	2	—	—	2	8	15	25	10	3 8	1 15	(d) £5 17 11¾	—	—	Nov.

D = Dead. * Disqualified under Clause 28 (more than 20 per cent second grade eggs) † Disqualified under Clause 28 (pen produced less than 960 eggs).

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade – Oct. 1–Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
†	30	Mrs. J. Foley,	1938 Mar. 29	169	4 14	D	17	18	21	15	10	10	19	17	12	7D	—	—	98	43	5	146	57	19 7¼	2 4	(a) 955	—	—	—
		Moyhill House,	,,	170	4 14	6 0	—	—	12	22	21	21	25	21	25	9	22	14	181	10	1	192	16	21 10¼	2 8	lb. oz. dr.	—	—	Oct., *June*
		Cratloe,	,,	171	4 14	D	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(b) 134 3 14		—	Oct.
		Co. Clare	,,	172	5 0	6 12	12	22	21	20	19	20	22	25	21	7	19	11	100	104	15	219	44	27 5¼	2 3	oz.	—	—	July, *June*
			,,	173	4 8	6 2	—	—	16	22	19	22	23	25	21	12	10	8	6	151	21	178	12	20 2¼	2 1	(c) 27 0	—	—	Oct., *July*
			,,	174	4 10	5 5	23	24	20	17	19	22	21	21	18	21	5	9	167	48	5	220	65	28 2¼	2 5	(d) £5 17 3¼	—	1	July
†	32	Mrs. M. Colleran,	1938 Feb. 15	181	5 8	5 12	19	8	—	7	21	21	23	13	12	15	18	5	—	30	123	153	—	15 2¼	1 14	(a) 673	13	4	Dec., July
		Cranaghmore,	,,	182	5 4	D	10	16	17	10	16	21	21	19	—	—	D	—	91	39	—	130	46	17 2	2 4	lb. oz. dr.	—	—	May
		Athlone,	,,	183	5 10	6 6	18	11	10	9	8	11	12	16	10	9	8	5	54	70	3	127	38	16 0¾	2 3	(b) 90 7 11	—	—	July, *June*
		Co. Roscommon	,,	184	5 2	5 8	16	12	20	19	15	13	6	—	—	—	—	—	71	30	—	101	53	14 11	2 3	oz.	—	—	July
			,,	185	5 0	D	5	8	11	6	2	—	—	—	1	D	—	—	14	18	1	33	25	5 5½	2 2	(c) 25 8	—	—	Feb.
			,,	186	5 3	D	19	16	15	16	13	13	17	18	8	—	—	D	113	16	—	129	50	17 8	2 5	(d) £4 6 0¾	—	—	June, *June*

D Dead.

† Disqualified under Clause 28 (pen produced less than 960 eggs)

SECTION III.—RHODE ISLAND RED—16 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug 4	Aug. 5–Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
			1938																					s d	oz dr				
*	48	Miss V Burdon,	Jan 31	277	5 7	5 0	24	22	21	22	18	23	25	24	16	12	12	11	—	43	187	230	12	25 7	1 14	(a) 1,355	6	2	July
		The Laurels,	Feb 12	278	5 0	4 6	21	21	21	22	19	20	25	26	22	21	21	5	3	116	125	244	32	28 1½	1 15	lb oz dr	2	—	Aug.
		Buttevant,	,,	279	6 6	6 2	19	16	18	15	13	15	21	22	24	22	24	10	1	105	113	219	41	24 8	1 15	(b) 170 11 8	1	—	July
		Co Cork	,,	280	5 10	5 8	—	7	21	21	17	21	25	26	26	23	21	12	1	46	173	220	6	22 4	1 14	oz.	2	—	*July*
			Feb 23	281	6 0	6 5	15	14	20	20	21	23	27	26	23	3	20	3	131	83	1	215	53	26 8	2 4	(c) 24 2	—	1	July, *June*
			,, 23	282	6 8	6 0	23	21	22	17	18	18	23	2	24	25	23	11	130	81	16	227	70	28 10	2 3	(d) £7 16 2½	—	1	*July*
			1938																										
1	51	Rev Bro Dominick	March	295	4 8	5 3	3	19	21	20	21	22	23	19	8	6	3	10	69	103	3	175	45	22 6	2 3	(a) 1,236	-	1	Oct., May
		Agricultural College,	,,	296	4 14	5 5	20	18	19	18	18	22	20	26	23	22	20	9	7	201	27	235	50	28 6¼	2 1	lb. oz dr	—	—	*July*
		Mountbellew,	,,	297	4 12	5 4	25	25	18	22	19	21	23	25	16	23	9	11	9	152	76	237	24	28 8¼	2 0	(b) 166 8 8	1	1	July
		Co Galway	,,	298	4 10	5 10	—	18	24	22	20	20	18	18	13	—	—	11	157	7	—	164	47	21 5¼	2 6	oz	—	2	Oct., June
			.	299	4 8	7 8	11	19	20	20	19	20	21	23	21	22	20	8	166	55	3	224	53	27 10½	2 4	(c) 25 9	—	—	Oct, *July*
			,,	300	5 0	5 4	19	20	18	16	15	20	25	24	22	1	10	11	87	108	6	201	61	25 4¾	2 3	(d) £7 14 5¾	—	1	June, *June*
			1938																										
2	53	Capt. H. M. S Redmond,	Feb 17	307	4 8	5 6	24	22	23	20	11	9	21	20	20	19	20	7	113	93	10	216	65	27 10¾	2 3	(a) 1,206	—	—	June
		Popefield,	.	308	5 2	6 10	26	20	17	16	17	19	18	16	18	11	15	4	148	48	1	197	65	25 5¾	2 4	lb. oz dr	—	—	June
		Athy,	,,	309	4 14	5 12	20	18	15	14	17	20	17	16	20	21	11	11	104	93	3	200	55	25 0¾	2 3	(b) 163 7 9	—	—	*July*
		(Loughlin)	,,	310	5 12	7 6	—	1	25	23	18	23	25	27	22	23	25	10	22	190	10	222	28	25 10½	2 2	oz	—	—	Oct., *July*
			,,	311	5 8	6 15	22	22	21	6	6	13	10	3	—	—	—	1	84	19	1	104	67	15 6	2 5	(c) 28 0	4	—	May
			,,	312	4 12	5 4	23	23	23	23	22	26	27	25	15	24	24	12	23	230	14	267	70	33 3¼	2 1	(d) £7 13 1½	—	1	June
			1938																										
3	54	Mrs L Hayes,	Feb. 21	313	6 0	7 0	14	17	20	18	17	20	22	25	25	23	23	8	27	187	18	232	50	28 2¼	2 2	(a) 1,260	1	—	July, *July*
		Walshestown,	,,	314	5 8	6 3	5	25	24	21	24	25	25	24	24	14	17	12	75	158	8	241	55	30 2¼	2 3	lb oz. dr.	—	2	June, *June*
		Castlemahon,	,,	315	5 12	6 6	17	21	20	21	22	23	23	26	21	22	22	11	6	194	49	249	46	29 11¾	2 1	(b) 167 4 1	1	—	*July*
		Newcastle West	,,	316	6 6	6 10	—	—	—	17	19	19	24	25	24	19	23	9	40	122	17	179	—	19 0¼	2 2	oz.	—	—	Oct., *July*
		Co Limerick	,,	317	6 8	7 8	17	18	15	16	17	20	21	23	22	21	21	10	97	122	2	221	52	27 1¾	2 3	(c) 25 5	—	—	June
			,,	318	5 12	D	12	11	4	14	15	18	26	25	13	D	—	—	65	67	6	138	24	16 7¾	2 3	(d) £7 11 2	1	—	—
			1938																										
4	58	Mrs. M. A. Miller,	Mar 17	337	5 2	5 12	23	24	23	22	19	20	20	20	16	10	14	7	133	77	8	218	68	28 4	2 4	(a) 1,238	—	2	Aug., *June*
		Millview,	,	338	5 8	6 4	—	16	10	14	24	23	25	19	13	14	4	1	2	17	144	163	3	16 10	1 14	lb. oz dr.	62	—	*July*
		Lenamore,	,,	339	4 10	6 0	5	24	22	20	18	19	22	22	19	19	11	3	183	20	1	204	53	26 1¼	2 5	(b) 167 5 5	—	—	—
		Rathowen,	,,	340	4 10	5 9	—	7	20	19	22	23	23	22	23	10	22	6	173	24	—	197	31	23 6¼	2 5	oz.	—	2	July, *June*
		(Co Longford)	,,	341	4 9	5 4	—	17	22	22	22	22	23	24	22	21	21	10	54	168	4	226	41	27 7½	2 2	(c) 25.9	—	—	—
			,,	342	5 4	6 3	21	20	20	18	18	19	22	20	21	19	22	10	12	186	32	230	37	28 4	2 1	(d) £7 10 9	1	—	*July*

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct 28	Oct 29-Nov. 25	Nov 26-Dec. 23	Dec. 24-Jan 20	Jan. 21-Feb. 17	Feb 18-Mar. 17	Mar 18-Apl 14	Apl 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug 4	ug 5-Aug 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
5	50	Mrs. M. Irwin,	1938 January	289	5 4	4 12	26	21	22	22	23	25	26	24	24	19	12	—	6	160	78	244	37	29 6	2 0	(a) 1,219	—	—	—
		Glencarrig,	„	290	6 0	6 8	9	9	1	11	4	21	23	24	21	18	—	—	63	78	—	141	22	16 1½	2 3	lb. oz. dr	—	1	July
		Delgany,	„	291	5 4	6 14	17	23	21	20	21	21	22	24	23	20	21	9	12	222	8	242	59	30 3¾	2 1	(b) 163 15 12	—	—	*July*
		Co. Wicklow.	„	292	5 6	6 2	8	18	15	9	—	15	21	22	21	22	13	4	153	15	—	168	43	20 7¾	2 6	oz.	—	—	Jan., *July*
			„	293	5 10	6 12	17	17	19	20	18	20	23	21	19	17	15	7	161	51	1	213	57	26 8¼	2 4	(c) 25 8	—	—	*July*
			„	294	4 8	5 4	17	20	18	18	18	20	23	20	18	18	18	3	40	165	6	211	56	26 6¼	2 2	(d) £7 9 10½	—	—	June
*	56	Mrs. M. J. Walker,	1938 Jan. 10	325	4 12	5 12	18	18	—	6	23	27	27	25	24	24	10	11	56	125	32	213	34	24 2½	2 2	(a) 1,235	1	1	Dec., *July*
		Lower Woodhead,	„	326	4 8	5 3	25	24	23	22	23	23	24	25	25	27	21	10	141	125	6	272	77	34 2	2 3	lb. oz. dr	—	—	*July*
		Ballyloughan,	„	327	4 8	5 0	19	19	19	17	17	20	24	18	19	4	19	8	—	30	173	203	21	22 3¼	1 14	(b) 161 12 10	10	—	July
		Bruckless P.O.,	„	328	4 9	4 15	17	24	21	20	19	21	21	20	13	11	8	10	7	151	47	205	47	25 8½	2 0	oz.	—	3	July, *June*
		Co. Donegal.	Feb. 26	329	4 8	5 0	2	21	19	18	2	16	23	23	19	22	16	1	56	92	34	182	46	22 1	2 2	(c) 25 2	—	—	Oct., Feb., *July*
			„	330	4 14	6 10	—	2	22	21	22	20	16	16	14	13	1	13	127	33	—	160	29	19 6¾	2 5	(d) £7 7 11½	—	3	Oct., June
6	47	Miss D. Strong,	1938 Feb 20	271	5 6	6 0	18	22	19	3	—	15	23	24	23	22	23	11	114	84	5	203	59	25 0¾	2 3	(a) 1,197	—	—	Jan., *July*
		Moate House,	„ 3	272	4 10	5 12	—	22	23	21	23	24	25	18	14	14	12	—	19	161	16	196	48	24 8½	2 1	lb. oz dr	1	3	June
		Ceanannus Mór,	Jan. 20	273	4 10	5 0	22	16	—	—	—	22	23	16	19	16	3	12	30	112	7	149	37	17 6½	2 1	(b) 160 2 15	—	3	Dec., July
		Co. Meath	Feb 20	274	4 8	5 8	20	26	25	23	22	22	22	26	22	24	23	11	37	189	40	266	60	32 11½	2 1	oz.	—	—	*July*
			„ 9	275	5 10	6 0	23	22	—	—	2	26	23	24	9	18	6	13	100	66	—	166	45	19 11½	2 4	(c) 25 7	—	2	Dec., June
			„ 20	276	4 8	5 10	18	22	20	17	18	21	22	19	19	18	17	6	132	84	1	217	63	27 7¼	2 3	(d) £7 7 10	1	—	*July*
7	60	Miss C. Mealiff,	1938 Mar. 25	727	5 8	6 8	20	22	20	20	20	20	22	23	21	16	13	5	219	3	—	222	66	28 4¾	2 8	(a) 1,250	—	—	*July*
		Ballinamona House,	„	728	4 14	5 14	1	2	—	8	22	24	25	26	24	23	22	10	34	150	3	187	2	20 0¾	2 2	lb oz dr	—	—	Oct., *July*
		Tullamore,	„	729	4 8	5 0	—	6	22	19	17	22	27	26	21	24	12	11	2	84	124	210	18	22 3¼	1 15	(b) 168 0 1	5	—	Oct., July
		Offaly.	Feb. 12	730	5 0	5 12	20	24	23	20	17	20	20	24	20	16	15	9	17	167	44	228	45	28 4½	2 1	oz	—	—	*July*
			Mar 17	731	4 8	5 0	—	18	12	—	4	20	24	23	24	25	24	12	71	111	4	186	28	21 5	2 3	(c) 25 8	1	—	Oct., Jan., *July*
			„	732	4 10	4 13	21	20	16	20	17	19	20	21	19	19	19	6	53	146	18	217	42	26 11½	2 2	(d) £7 7 5¼	—	—	*July*
8	55	Miss J. Weston,	1938 Mar 24	319	5 0	6 14	—	—	24	19	20	23	24	22	19	17	1	—	97	63	2	162	26	19 6¼	2 4	(a) 1,215	—	—	*July*
		Ballymadrough,	„	320	4 14	6 3	—	—	7	22	22	20	25	19	24	21	22	12	179	14	1	194	11	21 7½	2 6	lb. oz dr	—	—	Oct., *July*
		Donabate,	„	321	5 0	6 0	—	—	18	24	24	23	22	23	26	20	25	12	204	13	—	217	24	25 0½	2 6	(b) 168 2 8	—	—	Oct., *July*
		Co Dublin	„	322	5 13	6 8	16	23	17	20	19	15	21	16	16	9	—	—	5	131	36	172	32	22 1¼	2 0	oz.	—	—	*July*
			„	323	5 0	6 1	5	21	21	20	17	14	18	24	23	22	23	11	17	189	13	219	50	27 0½	2 1	(c) 26.6	—	—	*July*
			„	324	4 12	5 12	24	24	22	21	18	21	24	25	21	20	22	9	133	113	5	251	71	31 9	2 3	(d) £7 7 1½	—	—	*July*

* Disqualified under Clause 28 (more than 20 per cent. second grade eggs).

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz dr)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
9	46	Mrs. M. F Smith,	1938 February	349	5 3	6 0	—	—	—	19	18	18	23	24	21	22	17	7	160	9	—	169	4	18 5	2 6	(a) 1 156	—	—	Oct., July
		Bridge House,	,,	350	4 10	5 13	18	24	19	22	20	22	19	12	10	16	14	6	149	51	2	202	64	26 5¼	2 4	lb oz dr	—	—	July
		Bettystown,	,,	351	4 14	6 8	—	—	—	10	16	13	17	11	9	10	—	2	78	9	1	88	—	9 8¼	2 8	(b) 163 3 13	—	—	Oct., *July*
		Co. Meath	,,	352	5 0	5 4	22	24	23	23	22	21	23	23	17	18	15	6	16	189	32	237	66	29 11	2 1	oz	—	—	—
			,,	353	5 0	5 7	22	17	22	18	21	20	21	18	17	15	16	6	100	110	3	213	64	27 2¼	2 3	(c) 27 1	—	—	*July*
			,,	354	5 8	5 3	22	21	23	20	22	24	23	24	20	19	21	8	234	13	—	247	71	31 2¼	2 6	(d) £7 2 10¼	—	—	June
10	57	Mr. W. Murphy,	1938 Mar. 19	331	4 8	6 4	—	4	23	23	21	23	25	24	23	20	19	7	130	82	—	212	33	25 2¼	2 4	(a) 1,133	—	—	Oct., *July*
		Skeeter Park,	Jan. 26	332	4 10	5 4	21	21	6	18	20	20	18	17	11	10	6	8	44	122	10	176	44	22 4	2 2	lb. oz dr	—	6	June
		Cleariestown,	Mar. 19	333	4 12	6 6	20	13	11	13	15	21	19	23	13	11	12	10	2	119	60	181	11	21 0¼	2 0	(d) 154 4 8	—	8	June
		Co. Wexford.	,,	334	4 10	6 0	—	20	25	28	9	21	24	23	21	22	13	12	73	121	24	218	51	26 10¼	2 3	oz	4	1	Oct., Feb., July
			,,	335	4 8	6 2	7	22	25	23	21	20	12	17	12	7	7	—	60	107	6	173	56	23 2¼	2 2	(c) 26 2	—	—	Oct., June
			Jan. 26	336	5 0	6 8	—	2	22	22	23	21	20	16	16	10	2	13	166	7	—	173	30	20 11¼	2 6	(d) £6 19 7¼	—	4	Oct., June
11	59	Miss A. M. Dempster,	1938 Feb. 4	343	4 14	5 15	22	19	18	13	6	21	22	18	18	8	18	8	149	42	—	191	62	24 3	2 4	(a) 1,146	2	1	Jan., *June*
		Emo Park,	,,	344	5 6	6 0	23	21	21	20	18	19	20	22	20	9	14	6	91	114	8	213	61	27 4¼	2 3	lb oz dr	—	2	July
		Portarlington.	,,	345	6 4	7 6	—	—	19	19	16	18	22	22	13	19	20	5	72	96	5	173	23	20 1¼	2 3	(b) 157 8 2	—	2	June, *June*
		Laoighis.	Feb. 26	346	4 8	5 8	17	23	20	15	19	20	24	23	20	16	4	—	—	55	146	201	15	22 10¼	1 15	oz	13	—	June
			,, 4	347	6 0	6 3	22	22	17	—	12	22	20	22	19	13	15	6	138	52	—	190	61	23 11¼	2 4	(c) 26 4	—	2	*Jan.*
			,, 26	348	4 14	6 8	—	—	15	23	21	23	24	16	16	20	8	12	177	1	—	178	20	20 9¼	2 7	(d) £6 19 3¼	—	2	Oct., July
12	61	Mrs. S. Kelly,	1938 Mar. 3	733	5 0	5 15	—	—	4	21	11	17	23	18	13	11	17	2	109	28	—	137	8	15 5¼	2 5	(a) 1,101	—	4	Oct., July
		Pollerton,	,, 23	734	5 8	5 0	13	8	—	24	22	23	21	24	16	17	10	—	10	72	96	178	9	18 11¼	2 0	lb. oz dr.	6	—	Nov., *July*
		Carlow.	,, 23	735	5 4	5 12	—	17	25	23	21	22	24	22	16	10	—	1	46	131	4	181	44	23 2	2 2	(b) 145 1 14	1	—	July
			,, 3	736	5 6	6 12	3	—	17	18	19	20	20	23	21	19	17	7	6	151	27	184	16	20 9¼	2 0	oz.	1	—	Nov.
			,, 3	737	4 9	5 12	—	23	20	17	20	21	25	22	22	18	16	10	69	139	6	214	42	26 5¼	2 2	(c) 25.3	—	—	Oct.
			,, 23	738	5 8	7 4	10	23	23	19	18	18	21	22	17	15	13	8	30	131	46	207	23	25 8	2 1	(d) £6 10 6¼	—	—	*July*
*	52	Mrs. K. Earl,	1938 March	301	4 12	5 8	12	19	19	15	18	21	16	—	—	—	—	—	—	50	70	120	9	15 7¼	1 15	(a) 1,055	1	—	*May*
		Grantstown House,	,,	302	4 8	5 8	—	1	20	21	19	21	23	22	15	15	12	10	125	52	2	179	23	21 1¼	2 4	lb oz dr	—	2	Oct., *July*
		Waterford.	,,	303	4 14	6 0	18	18	10	16	15	19	21	19	18	21	14	10	52	135	12	199	38	24 3¼	2 2	(b) 136 4 14	—	—	July
			,,	304	4 8	5 0	19	22	16	17	18	23	22	22	3	—	—	—	—	7	155	162	1	18 4¼	1 14	oz.	10	—	*June*
			April	305	4 10	6 0	—	10	21	23	22	26	26	25	14	23	23	4	1	71	145	217	3	23 0¼	1 15	(c) 24 8	2	1	Oct., *July*
			March	306	5 2	6 3	15	20	20	17	19	21	20	20	6	16	4	—	130	45	3	178	56	23 2	2 4	(d) £6 5 8	—	2	July

* Disqualified under Clause 28 (more than 20 per cent. second grade eggs).

SECTION III.—RHODE ISLAND RED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct 1-Oct 28	Oct 29-Nov 25	Nov 26-Dec 23	Dec. 24-Jan 20	Jan 21-Feb. 17	Feb 18-Mar 17	Mar 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
†	49	Miss M. O'Donovan,	1938 February	283	5 8	5 12	17	18	19	17	18	21	23	24	21	22	21	10	77	136	18	231	41	28 2¼	2 2	(a) 923	—	—	*July*
		Dromore,	,,	284	5 8	5 12	21	21	19	19	19	22	22	23	10	19	22	10	107	116	4	227	61	28 7¾	2 3	lb oz dr	1	1	June
		Villierstown,	,,	285	5 12	D	18	16	6D	—	—	—	—	—	—	—	—	—	39	1	—	40	40	6 10¼	2 4	(b) 131 5 6	—	—	—
		Cappoquin,	,,	286	5 12	6 4	—	20	15	8	21	21	23	22	21	23	17	9	193	7	—	200	35	24 2	2 5	oz	—	—	Oct., *July*
		Co Waterford.	,,	287	5 12	D	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(c) 27 3	—	—	—
			,,	288	5 2	6 0	—	23	23	19	17	20	23	24	19	22	26	9	217	8	—	225	50	27 11½	2 7	(d) £5 15 10½	—	—	*July*

D=Dead.

† Disqualified under Clause 28 (Pen produced less than 960 eggs).

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—17 PENS

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of test lb. oz	Eggs Laid: Oct. 1-Oct. 28	Oct 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan 21-Feb 17	Feb. 18-Mar. 17	Mar 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec. 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen. (b) Total weight (c) Av weight per dozen (d) Total value from pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
			1938																					s. d.	cz dr				
1	75	Mrs. M O'Grady,	Feb 6	457	5 4	5 12	21	18	19	20	19	22	24	24	23	24	23	10	93	149	5	247	62	30 6	2 3	(a) 1,309	—	—	*June*
		Islandeady,	Mar 4	458	5 8	6 0	18	21	21	17	18	21	24	6	9	17	11	—	58	119	6	183	57	24 1½	2 2	lb oz dr	—	—	*June*
		Castlebar,	,,	459	5 0	5 4	21	23	21	20	23	23	23	20	25	20	16	8	235	8	—	243	70	30 9¾	2 7	(b) 185 3 4	—	—	*June*
		Co. Mayo.	Feb 6	460	4 8	5 2	19	18	19	20	18	20	21	23	19	20	17	8	126	93	3	222	58	27 9¼	2 3	oz	—	—	*July*
			,,	461	5 8	5 11	23	23	21	18	19	20	24	25	20	21	20	10	201	43	—	244	70	30 9½	2 5	(c) 27 2	—	—	July, *June*
			,,	462	5 8	5 10	17	22	20	21	20	22	15	14	8	8	3	—	152	18	—	170	64	22 11¾	2 6	(d) £8 6 11¼	—	—	June
			1938																										
2	65	Miss M. O'Donovan,	March	379	5 12	6 11	16	20	17	17	20	19	21	22	20	19	16	8	195	20	—	215	57	26 11½	2 5	(a) 1,346	—	—	*July*
		Dromore,	,,	380	5 4	5 12	7	23	20	12	16	18	19	22	21	21	20	10	67	130	12	209	42	25 11	2 2	lb oz dr.	—	—	*July*
		Villierstown,	,,	381	5 4	6 8	6	19	21	17	18	21	23	26	23	21	19	11	219	6	—	225	49	27 8½	2 7	(b) 189 13 6	—	—	*July*
		Cappoquin,	,,	382	5 12	6 6	24	22	21	20	1	21	27	26	25	24	21	10	4	128	110	242	27	28 1¼	2 0	oz	2	—	Feb , *July*
		Co. Waterford	,,	383	5 14	6 10	22	23	22	22	20	21	22	19	21	17	14	4	162	63	2	227	71	29 3¾	2 4	(c) 27 1	—	—	*July*
			,,	384	6 8	7 6	9	21	21	12	2	24	23	27	26	27	24	12	224	4	—	228	56	27 9¼	2 7	(d) £8 5 8¾	—	—	Jan., *July*
			1938																										
3	70	Miss C. Mealiff,	Mar 17	409	5 0	6 11	16	19	20	20	17	21	20	25	22	22	8	11	97	116	8	221	55	27 7½	2 3	(a) 1,364	—	1	*June*
		Ballinamona House	,,	410	4 8	5 8	19	14	14	13	13	20	25	28	26	24	21	11	4	94	130	228	16	24 7	1 15	lb oz dr	3	—	*July*
		Tullamore,	,,	411	5 3	6 15	—	7	23	25	24	26	27	28	26	26	22	12	73	167	6	246	34	28 11½	2 3	(b) 181 4 2	—	—	Oct., *July*
		Offaly	,,	412	5 0	6 0	23	17	20	18	16	18	23	25	24	22	13	—	125	93	1	219	63	27 6¾	2 4	oz	—	—	*July*
			,,	413	4 10	5 5	—	16	23	20	2	23	27	26	24	23	20	9	91	121	1	213	43	25 9½	2 3	(c) 25 5	—	—	Oct ,Feb.,*July*
			,,	414	4 10	5 4	21	23	21	22	23	25	24	24	8	19	17	10	24	178	35	237	50	29 6¼	2 1	(d) £8 4 0	—	1	*July*
			1938																										
*	63	Mrs. S. Kelly,	Mar 3	367	4 8	5 12	—	3	21	21	22	22	23	25	24	22	22	9	1	10	203	214	—	20 10¼	1 14	(a) 1 358	3	—	Oct., *July*
		Pollerton,	,,	368	4 8	6 0	—	15	23	20	21	24	26	21	23	21	21	10	—	147	78	225	24	25 9	2 0	lb oz dr.	1	—	Oct., *July*
		Carlow	,,	369	5 4	6 4	22	22	21	22	19	22	26	25	25	23	24	12	153	110	—	263	69	32 10	2 3	(b) 173 14 11	—	—	*July*
			Mar. 23	370	5 4	5 7	21	23	21	22	21	25	27	26	19	26	4	9	14	171	59	244	31	29 8½	2 0	oz	1	2	July
			,,	371	4 14	5 9	22	22	19	19	20	19	24	24	7	14	17	9	28	136	52	216	27	26 6¾	2 1	(c) 24 6	1	3	July
			,,	372	5 0	5 3	25	—	20	15	13	25	24	27	25	5	17	—	60	120	16	196	38	23 3½	2 2	(d) £7 18 11¼	—	4	Nov., July
			1938																										
4	74	Mrs. M F. Smith,	February	433	5 14	6 0	21	20	22	18	18	21	20	23	19	20	20	8	217	13	-	230	67	29 1	2 5	(a) 1,251	—	—	—
		Bridge House,	,,	434	4 14	5 6	1	24	21	21	20	22	20	23	20	17	2	10	186	15	—	201	51	25 6½	2 5	lb oz dr.	—	1	July
		Bettystown,	,,	435	5 0	5 14	26	23	14	25	22	25	22	21	25	21	20	12	23	196	37	256	37	31 3½	2 2	(b) 176 0 11	1	—	*July*
		Co. Meath	,,	436	5 4	5 12	23	24	22	21	20	22	22	23	25	24	21	11	213	45	—	258	74	32 7¼	2 5	oz	—	—	*July*
			,,	437	5 14	6 0	22	14	9	4	—	—	15	18	13	5	7	—	31	70	6	107	45	13 10¼	2 2	(c) 27 0	—	—	Jan , *June*
			,,	438	5 14	6 12	23	21	17	6	—	15	23	22	22	20	20	10	180	19	—	199	64	24 10¾	2 5	(d) £7 17 3¼	—	—	Jan., *Jan.*

* Disqualified under Clause 28 (more than 20 per cent second grade eggs).

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz	Weight At close of Test lb. oz	Eggs Laid Oct 1-Oct 28	Oct. 29-Nov 25	Nov 26-Dec 23	Dec 24-Jan 20	Jan 21-Feb 17	Feb 18-Mar 17	Mar. 18-Apl 14	Apl 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug 4	Aug 5-Aug 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
5	76	Mr. W Murphy,	1938 Mar 19	445	4 9	6 4	12	24	25	25	25	26	25	25	25	18	22	10	28	211	23	262	59	32 6¼	2 1	(a) 1,282	—	—	*July*
		Skeeter Park,	Feb 21	446	4 9	5 12	24	17	24	6	16	24	24	17	15	12	11	—	155	30	5	190	65	24 6½	2 5	lb oz dr.	—	1	Jan., *July*
		Clearestown,	"	447	4 12	6 8	—	8	12	—	16	15	17	20	11	11	14	2	3	76	47	126	3	13 11	2 0	(b) 168 0 11	2	6	Oct., Dec. July
		Co. Wexford	"	448	4 8	5 10	22	22	24	20	22	23	25	26	26	23	19	9	35	181	25	261	52	32 4	2 2	oz	—	—	Dec
			"	449	5 0	5 4	22	21	22	21	23	25	27	17	28	27	23	13	10	192	67	269	17	32 3¼	2 0	(c) 25 2	3	—	*July*
			"	450	4 8	4 13	—	—	20	23	22	25	24	26	23	11	—	—	4	145	25	174	23	20 1½	2 1	(d) £7 15 8¾	—	—	*July*
*	69	Mrs. E. O'Donnell,	1938 Feb 8	403	5 0	7 0	17	22	23	24	21	24	13	25	10	—	—	—	13	145	19	177	62	23 6¾	2 1	(a) 1 216	—	2	June
		Kilbreedy West	"	404	5 8	5 12	24	9	—	—	24	24	26	28	28	25	21	6	6	109	100	215	9	22 3½	2 0	lb oz dr	—	1	Nov.
		Kilmallock,	"	405	5 14	5 14	17	10	18	20	20	23	24	26	20	22	23	12	119	108	8	235	40	28 2¾	2 3	(b) 157 5 4	—	—	*July*
		Co Limerick	"	406	5 6	5 12	19	20	21	20	20	22	22	20	11	11	4	9	34	159	6	199	60	25 8¾	2 2	oz	—	2	June
			"	407	4 12	5 6	11	23	22	22	19	18	20	23	23	20	16	6	1	24	198	223	4	24 3¼	1 14	(c) 24 8	3	—	June
			"	408	5 8	6 10	10	7	19	19	18	21	18	20	9	12	14	—	118	47	2	167	39	20 9¾	2 4	(d) £7 4 10¾	1	4	June
6	64	Mrs. H. Langrell,	1938 Feb. 16	373	5 0	6 1	—	22	20	18	18	19	20	21	16	18	7	10	147	42	-	189	46	23 10¼	2 5	(a) 1 117	—	1	Oct., June, *June*
		Killinure House	"	374	4 8	5 6	17	22	18	17	16	17	16	20	15	10	11	3	168	13	1	182	59	23 9¼	2 6	lb oz dr	—	1	July
		Tullow,	"	375	4 8	5 7	—	17	22	19	22	22	24	15	16	16	10	11	128	66	-	194	44	24 3¼	2 4	(b) 157 14 13	—	1	Oct., June
		(Co Wicklow)	"	376	5 0	5 0	8	25	19	20	21	23	21	23	18	—	—	-	52	127	2	181	55	23 9¼	2 2	oz	—	2	July, *June*
			"	377	4 12	6 4	—	14	22	19	18	22	22	11	20	14	7	13	47	129	6	182	36	22 7	2 2	(c) 27 1	—	2	Oct., June
			"	378	5 3	6 0	—	19	20	15	15	21	22	23	24	11	12	7	183	5	1	189	42	23 4¾	2 7	(d) £7 1 8¾	—	1	Oct., June
7	66	Mrs J McCarthy,	1938 Mar 8	385	5 8	6 12	20	20	18	12	3	23	22	18	21	14	22	11	95	105	4	204	61	25 4¼	2 3	(a) 1 138	—	2	June, *Feb.*
		Caherelly Castle	"	386	7 0	6 6	—	4	18	19	18	21	22	22	11	18	17	—	162	8	-	170	26	20 3	2 6	lb oz dr	—	2	Oct., *July*
		Grange,	"	387	4 14	5 8	—	9	20	20	19	19	23	24	10	21	1	5	165	6	—	171	35	20 11¾	2 7	(b) 166 5 15	—	1	Oct., July
		Kilmallock,	"	388	5 4	5 0	25	17	22	17	17	16	10	17	20	5	12	—	104	72	2	178	69	23 7¼	2 3	oz	—	—	June
		Co Limerick	"	389	5 4	6 4	19	17	14	16	3	18	21	24	20	22	20	12	201	5	-	206	54	25 3¼	2 8	(c) 28 1	—	—	*Feb*, *July*
			"	390	5 4	6 8	-	20	25	20	10	23	24	25	20	14	11	9	195	13	—	208	47	25 11¼	2 5	(d) £7 1 7¼	—	2	Oct., June
				U T	—	—	—	1	-	-	—	—	-	-	—	—	—	—	-	—	1	1	—	2	1 13		—	—	—
8	62	Miss B. Buckley,	1938 Feb 24	361	5 3	6 4	8	18	15	—	—	24	17	15	15	17	18	4	77	70	4	151	41	18 5¼	2 3	(a) 1,200	—	3	Jan., July
		Ballyogaha,	"	362	4 12	6 2	20	22	—	17	26	25	25	14	13	21	15	3	16	132	53	201	24	23 8¼	2 0	lb oz dr	1	5	Nov., June
		Ballincurrig,	Feb. 17	363	5 6	5 12	20	23	3	18	15	20	22	21	9	10	17	7	141	39	5	185	46	23 0¾	2 4	(b) 160 2 11	1	3	Dec., June
		Midleton,	Jan. 30	364	5 12	7 12	16	—	—	—	17	20	23	24	23	22	19	10	152	21	1	174	15	18 10¾	2 5	oz	—	—	Nov.
		Co. Cork.	"	365	5 4	6 4	20	17	2	5	21	22	23	26	24	24	22	11	61	143	13	217	34	25 1¾	2 2	(c) 25 6	—	—	Dec.
			Feb. 17	366	4 10	7 0	17	26	28	24	27	25	26	22	22	24	23	8	28	113	131	272	3	31 11	2 0	(d) £7 1 0¾	2	—	*July*

U T. = Untrapped

* Disqualified under Clause 28 (more than 20 per cent. second grade eggs)

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct 1–Oct. 28	Oct. 29–Nov. 25	Nov 26–Dec. 23	Dec. 24–Jan 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
9	77	Mrs. C Healy,	1938 Feb 15	451	5 2	5 0	3	19	22	22	21	22	19	15	15	15	17	6	2	64	130	196	1	22 2¼	1 15	(a) 1,183	12	—	Oct., *July*
		Bweeng P O,	,,	452	5 12	6 4	—	—	2	22	22	21	22	23	21	18	20	10	102	79	—	181	7	20 0	2 3	lb oz dr	—	—	Oct.
		Mallow,	,,	453	4 12	5 4	—	—	11	18	12	18	20	22	14	17	19	—	10	136	5	151	11	17 1¼	2 2	(b) 154 12 5	—	2	Oct.
		Co Cork.	,,	454	5 2	5 6	—	—	23	22	20	21	24	25	23	25	25	12	21	132	67	220	26	24 3¼	2 1	oz	—	—	Oct.
			,,	455	6 0	6 6	21	20	22	22	20	22	23	25	24	6	20	5	145	84	1	230	67	29 2¾	2 4	(c) 25.1	—	2	Aug., *June*
			,,	456	5 14	6 0	18	18	—	—	15	21	25	25	25	22	24	12	11	169	25	205	15	23 1¾	2 1	(d) £6 16 0¼	—	—	Dec
10	73	Miss J Weston	1938 Mar 14	427	5 14	6 0	22	20	21	21	14	19	22	17	13	16	12	8	149	56	—	205	68	26 6¾	2 4	(a) 1,112	—	1	July
		Ballymadrough,	,,	428	6 0	6 6	25	24	21	22	21	22	21	27	25	26	26	13	13	224	36	273	55	33 5¼	2 1	lb oz dr	—	—	*July*
		Donabate,	,,	429	5 9	7 7	21	19	12	—	—	—	—	—	—	—	—	—	27	24	1	52	51	8 11	2 2	(b) 148 7 7	1	—	Jan.
		Co. Dublin.	,,	430	5 8	5 15	22	19	17	20	19	23	24	24	22	21	21	8	1	63	176	240	2	26 1½	1 14	oz	13	1	—
			Mar 24	431	5 8	6 12	14	2	7	20	20	17	20	25	21	21	23	9	154	43	2	199	26	22 10¾	2 4	(c) 25 6	—	—	*July*
			,,	432	5 12	6 4	1	19	5	—	—	18	23	21	7	25	11	13	134	9	—	143	25	16 8¼	2 7	(d) £6 14 8	—	2	Dec.
11	68	Mrs. A. Ferguson,	1938 Mar. 3	397	5 0	D	—	3	22	4	—	—	—	—	—	—	—	—	26	3	—	29	29	5 1½	2 4	(a) 957	—	—	Oct.
		Cloghboley,	,,	398	5 12	6 12	4	—	—	—	11	22	23	26	27	25	26	12	1	124	51	176	—	17 3¼	2 0	lb. oz dr.	—	—	Oct.
		Sligo	,,	399	4 12	5 11	17	—	11	24	23	24	28	18	18	13	16	3	143	45	7	195	26	22 10	2 5	(b) 136 2 0	—	4	Nov., July, *June*
			,,	400	5 0	6 12	—	4	13	7	15	19	15	16	2	—	—	—	9	66	16	91	15	10 10¼	2 1	oz.	—	—	Oct., June, *June*
			,,	401	5 12	6 2	26	24	23	22	20	22	24	24	22	23	23	11	24	228	12	264	72	33 3¼	2 1	(c) 26 5	—	—	—
			,,	402	5 4	6 1	12	21	19	20	22	19	24	24	22	21	21	7	228	4	—	232	56	28 11¼	2 8	(d) £5 18 3¾	—	—	—
12	67	Mrs M Kieran,	1938 April 5	391	6 10	7 4	—	—	—	5	17	18	21	19	25	22	18	11	106	49	1	156	—	16 6¼	2 4	(a) 1,071	—	—	July
		Dowdstown,	Mar. 11	392	5 14	6 12	18	20	15	—	8	20	23	23	21	22	21	11	80	116	6	202	49	24 5¼	2 3	lb. oz. dr.	—	—	Dec., *July*
		Ardee,	,,	393	5 14	7 0	—	—	2	23	19	21	24	24	17	15	12	12	54	114	1	169	8	18 8¾	2 3	(b) 141 2 5	—	1	July, *June*
		Co Louth	,,	394	5 8	6 10	19	18	15	8	—	4	25	28	26	22	24	10	112	86	1	199	54	24 3¼	2 3	oz.	—	—	Jan.
			April 5	395	5 3	5 14	3	9	12	19	12	16	23	23	23	21	19	11	—	14	177	191	2	18 8¼	1 14	(c) 25.3	9	—	*July*
			Mar 11	396	5 3	6 4	—	—	—	—	14	19	20	24	23	22	21	11	6	124	24	154	—	15 6	2 1	(d) £5 18 2¼	—	—	Oct., *July*
13	71	Mrs. M. Crute,	1938 March	415	4 8	5 12	19	23	20	14	—	17	27	27	25	25	24	13	—	187	47	234	32	28 0¼	2 0	(a) 960	1	—	Jan., *July*
		Tulla,	,,	416	5 4	6 8	9	24	23	20	20	21	22	20	18	17	5	7	188	18	—	206	61	26 8¼	2 6	lb oz. dr.	—	1	*July*
		Three Castles,	,,	417	4 12	7 4	—	—	—	—	—	4	16	—	—	—	—	—	7	10	3	20	—	2 0¼	2 2	(b) 131 7 9	—	—	Jan.
		Co. Kilkenny	,,	418	4 14	6 4	18	24	22	18	14	21	25	24	23	23	23	9	179	63	2	244	68	30 6¼	2 4	oz.	—	—	*July*
			,,	419	4 8	5 5	24	9	—	—	—	16	26	—	11	8	6	9	43	66	—	109	33	13 2¼	2 3	(c) 26.3	—	5	Nov.
			,,	420	4 12	5 8	14	—	—	—	13	18	24	26	10	24	8	10	87	55	5	147	9	15 8¼	2 3	(d) £5 16 3	—	2	Nov., June, *June*

D. = Dead.

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No of Pullet	Weight: On Arrival (lb oz)	Weight: At close of test (lb oz)	Eggs Laid: Oct 1–Oct. 28	Oct. 29–Nov. 25	Nov 26–Dec. 23	Dec 24–Jan. 20	Jan 21–Feb. 17	Feb 18–Mar. 17	Mar. 18–Apl 14	Apl 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug 4	Aug 5–Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1–Dec. 29	Value per Pullet (s d)	Average Weight of Eggs per Pullet (oz dr)	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
†	78	Mr. R M Burke,	1938 March	355	5 2	6 0	–	4	21	15	8	21	27	26	24	26	24	11	[illegible]	127	71	207	27	22 5	2 0	(a) 738	1	—	Oct., Jan., *July*
		Toghermore P F,	,,	356	4 8	5 4	3	17	20	21	19	17	12	16	14	11	3	1	103	45	3	174	42	20 1¼	2 4	lb oz dr	—	—	Oct., *July*
		Tuam,	,,	357	5 4	D	—	—	7	23	22	25	24	6D	—	—	—	—	[illegible]	[illegible]	3	107	9	12 8¼	2 2	(b) 98 2 12	—	—	Oct.
		Co Galway	,,	358	5 8	5 0	22	22	21	18	18	19	22	23	21	11	16	6	130	75	—	213	60	26 4	2 3	oz	—	1	July
			,,	359	4 8	D	9	–	D	—	—	—	—	—	—	—	—	—	—	8	1	9	5	2 7¼	2 0	(c) 25 1	—	—	Oct.
			,,	360	4 8	D	22	5	6	14	1	D	—	—	—	—	—	—	—	11	37	48	4	6 8¼	1 14	(d) £44 10 8¼	—	—	Nov., Feb.
*†	72	Miss K. Cannon,	1938 February	421	5 6	D	—	8	12	12	—	21	7	—	D		—		56	4	—	60	24	8 4¼	2 6	(a) 760	1	—	Oct., Jan.
		Ballyedmonduff,	,,	422	5 2	D	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	lb oz dr	—	—	—
		Sandyford,	,,	423	5 2	6 7	—	11	20	26	23	22	27	27	26	23	11	11	50	129	2	217	27	25 3¼	2 3	(b) 102 2 3	—	1	Oct., July
		Co Dublin	,,	424	5 6	5 0	—	11	16	13	12	15	16	20	20	21	9	—		—	156	156	—	15 11	1 13	oz	15	—	July
			,,	425	4 14	5 12	—	11	13	—	—	21	24	16	16	10	11	5	113	16	1	130	24	15 4	2 6	(c) 25 8	—	5	Jan., July, *Jan.*
			,,	426	4 12	6 0	—	12	22	12	16	25	25	25	12	26	15	7	69	121	7	197	38	23 6¼	2 3	(d) £4 8 5¼	—	2	Oct., Jan., *July*

D—Dead   * Disqualified under Clause 28 (more than 20 per cent second grade eggs)   † Disqualified under Clause 28 (pen produced less than 960 eggs)

SECTION V.—ANY NON-SITTING BREED—18 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl 15-May 12	May 13—June 9	June 10-July 7	July 8-Aug 4	Aug 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	92	*White Leghorn*	1938																										
		Mrs F. Hanbidge	Feb 19	511	3 10	4 14	—	20	26	25	22	24	26	27	25	27	23	11	178	98	2	258	51	31 7¼	2 4	(a) 1,462	—	—	Oct
		Blackrath,	..	512	3 8	4 6	18	22	19	14	4	20	27	23	23	22	22	11	3	129	93	225	32	28 0¼	1 15	lb oz dr	—	—	*July*
		Ballytore,	..	513	3 8	4 4	18	—	3	23	27	26	28	24	27	26	25	14	128	112	2	242	26	27 3¼	2 3	(b) 198 14 12	—	—	Nov.
		Co Kildare	..	514	3 14	4 5	18	—	19	22	22	20	27	27	24	26	28	12	152	94	—	246	42	28 9¼	2 4	oz.	—	—	Nov., June
			..	515	3 14	4 3	18	22	20	15	22	21	26	24	24	24	26	13	50	174	34	258	53	31 3	2 2	(c) 26 1	1	—	*July*
			..	516	3 12	4 4	21	20	4	10	18	24	25	26	25	24	27	11	173	59	1	233	45	27 8¼	2 4	(d) 8 12 7¾	—	—	Dec
2	86	*White Leghorn*	1938																										
		Miss K. Cunningham	Mar. 14	475	4 8	4 10	17	19	21	14	19	22	20	27	24	24	20	12	107	129	9	245	53	29 11¼	2 3	(a) 1,374	1	—	*July*
		Monreade P F,	Mar 23	476	4 8	4 14	16	18	13	—	14	15	24	23	22	23	14	9	150	39	7	196	40	23 6	2 4	lb oz dr	—	—	Jan, *July*
		Naas	,	477	4 10	5 0	15	18	17	15	15	17	25	22	21	23	22	9	207	9	1	217	53	26 8¼	2 6	(b) 193 8 14	—	—	—
		Co Kildare	..	478	4 8	5 1	20	22	20	20	20	22	27	23	23	24	25	12	232	22	2	256	65	31 10	2 5	oz.	—	—	*July*
			..	479	4 8	5 8	22	20	16	—	17	21	24	25	22	21	22	9	80	118	21	219	37	26 4¼	2 3	(c) 27.0	—	—	Jan.
			..	480	4 4	4 8	21	20	22	16	19	21	23	24	22	21	22	10	159	80	2	241	64	30 1¼	2 3	(d) £8 8 6	—	—	July
3	95	*White Leghorn*	1938																										
		Miss A. Fitzgerald	March	505	4 12	5 6	21	20	14	—	18	22	22	25	24	22	21	10	204	14	1	219	54	26 6¾	2 6	(a) 1,324	—	—	Jan, *July*
		Ardgoul,	,	506	4 8	4 15	18	18	18	13	14	19	21	18	19	20	18	9	123	63	19	205	37	25 3	2 3	lb oz dr	—	—	*July*
		Rathkeale,	,	507	4 14	5 1	14	22	19	4	10	24	25	24	25	22	22	10	180	41	—	221	58	27 0	2 5	(b) 187 2 12	—	—	Jan
		Co Limerick.	.	508	4 8	4 15	23	23	20	18	18	20	22	22	22	22	19	10	114	115	10	239	59	30 0¼	2 3	oz	—	—	*July*
			..	509	4 10	5 4	19	22	20	18	16	19	19	18	20	13	16	7	115	80	12	207	52	26 4¼	2 3	(c) 27 1	—	—	*July*
			,,	510	4 0	4 8	22	22	19	18	19	17	23	23	21	21	19	9	202	31	—	233	67	29 4¼	2 5	(d) £8 4 7½	—	—	*July*
4	101	*White Leghorn*	1938																										
		Mrs. M. A. Forster.	Feb 15	721	4 0	5 0	17	17	20	2	22	21	24	24	24	20	22	10	206	15	2	223	53	27 1¼	2 6	(a) 1,312	—	—	Jan, *July*
		Tattybrack,	,,	722	4 4	4 12	24	24	20	8	18	22	23	21	27	24	22	3	30	161	45	236	61	28 7¾	2 1	lb. oz dr	—	—	—
		Rockcorry,	,,	723	3 8	4 9	24	22	23	15	20	21	22	26	23	21	13	—	161	65	4	230	68	29 3	2 4	(c) 182 0 8	—	—	*July*
		Co Monaghan	,,	724	4 0	5 0	21	18	3	—	14	21	21	25	23	7	17	6	38	120	18	176	30	20 7¾	2 2	oz	—	—	Dec., *June*
			,,	725	3 8	4 0	16	20	19	18	17	19	22	23	22	18	20	9	196	27	—	223	59	27 11¼	2 5	(c) 26 6	—	—	*July*
			,,	726	3 10	4 4	18	18	16	14	16	22	24	22	26	23	19	7	104	118	2	224	51	27 6	2 3	(d) £8 1 1¼	—	—	*July*
5	88	*White Leghorn*	1938																										
		Mrs. M. Hanly,	March	487	4 2	5 9	—	—	9	17	2	13	27	25	26	22	22	12	157	18	—	175	13	19 4	2 5	(a) 1,238	—	—	Oct, Feb
		Cooga,	,,	488	4 9	4 10	20	19	17	18	18	21	23	21	23	20	20	8	139	83	6	228	55	28 3¼	2 3	lb. oz. dr.	—	—	—
		Doon,	,	489	3 14	4 12	—	12	16	—	16	20	24	25	25	22	19	8	5	131	51	187	9	20 7¼	2 0	(b) 167 15 1	—	—	Oct, Jan
		Co Limerick	,,	490	4 0	5 0	21	23	20	18	19	22	22	27	24	22	19	13	126	121	3	250	65	31 1¼	2 3	oz.	—	—	*July*
			,,	491	4 2	4 8	21	21	19	20	17	21	25	24	22	23	21	10	22	194	28	244	43	29 10¼	2 1	(c) 26.0	—	—	*July*
			,,	492	3 12	4 2	13	18	5	8	14	20	22	21	17	—	10	6	99	53	2	154	35	18 10¼	2 4	(d) £7 8 2¼	1	—	June

SECTION V —ANY NON-SITTING BREED -continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb oz)	Weight: At close of test (lb oz)	Eggs Laid: Oct. 1-Oct 28	Oct. 29-Nov. 25	Nov. 26-Dec 23	Dec 24-Jan. 20	Jan 21-Feb. 17	Feb. 18-Mar 17	Mar 18-Apl 14	Apl 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug 4	Aug 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet (s d.)	Average Weight of Eggs per Pullet (oz dr)	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
6	85	*White Leghorn* Mrs. A. M Nelson,	1938 Feb 16	469	3 12	4 0	—	—	13	2	20	22	25	25	25	24	20	10	40	125	21	186	12	20 2¼	2 2	(a) 1,172	—	—	Oct., *July*
		Derry,	,,	470	3 14	5 9	22	19	17	23	20	21	20	16	19	13	16	7	73	112	19	204	44	25 10¼	2 3	lb oz dr	—	—	*July*
		Shercock,	,,	471	5 12	4 2	21	23	18	22	17	22	22	20	20	22	18	8	42	169	23	234	61	22 1¼	2 2	(b) 160 12 8	1	—	*July*
		Co Cavan	,,	472	4 6	5 8	19	17	12	16	17	18	22	17	13	22	16	2	182	9	—	191	52	23 10¾	2 8	oz	—	—	*July*
			,,	473	3 14	4 4	24	25	24	23	24	23	25	19	20	24	24	12	42	194	31	267	55	33 3¼	2 2	(c) 26 3	—	—	*July*
				474	4 0	D	17	21	21	13	9	9	—	—		—	D	—	79	11		90	63	14 2¼	2 5	(d) £7 6 7¼	—	—	—
*	89	*White Leghorn* Mr. R. Finnegar	1938 March	493	4 0	4 13	22	20	22	21	19	22	27	25	23	24	21	9	5	180	70	255	30	30 4¼	2 0	(a) 1,202	—	—	*July*
		Stoneyford	,,	494	4 4	4 13	21	22	23	22	22	24	25	24	23	23	21	11	41	184	35	260	52	32 0	2 1	lb oz. dr	—	—	*July*
		Thomastown,	,,	495	4 0	4 12	16	19	13	—	11	21	22	26	23	21	20	11	46	131	26	203	24	23 10¾	2 2	(b) 151 8 7	—	—	*Dec., July*
		Co Kilkenny	,,	496	3 8	D	—	6	13	D	—	—	—	—	—	—	—	—	1	10	8	19	11	3 4¾	2 0	oz	—	—	Oct
			,,	497	3 12	4 8	8	23	22	21	18	21	19	18	17	16	12	8	1	43	160	204	11	22 11¼	1 14	(c) 24.2	14	—	Oct., *July*
			,,	498	3 8	4 12	21	25	24	23	23	25	26	23	20	20	21	19	5	158	98	261	20	31 1¼	2 0	(d) £7 3 9¼	1	—	*July*
7	102	*White Leghorn* Mrs M. E. Shanley,	1938 March	559	3 8	4 10	22	23	20	23	19	22	20	22	18	19	14	4	128	97	1	226	69	29 1	2 3	(a) 1 066	—	—	—
		Dromard,	,,	560	3 6	D	13	21	20	17	22	19	24	5D	—	—	—	—	97	42	2	141	58	19 7	2 4	lb oz dr	—	—	—
		Dromod,	,,	561	3 10	4 8	14	22	20	9	—	12	20	22	23	22	19	3	78	106	8	192	53	24 0¼	2 3	(b) 144 10 2	—	—	Oct., Jan., *July*
		Co Leitrim	,,	562	3 8	4 6	9	19	16	6	9	11	15	14	18	17	12	—	33	98	15	146	41	18 5¾	2 2	oz	—	1	*Oct., July*
			,,	563	3 8	5 0	17	17	19	17	18	19	25	24	13	13	7	—	78	90	21	189	36	23 9	2 2	(c) 26 0	1	—	Oct., *July*
			,,	564	3 12	5 0	15	18	18	7	16	18	13	13	15	16	14	—	61	104	7	172	50	21 9¾	2 3	(d) £6 16 7¾	—	—	Oct., *July*
8	91	*White Leghorn* Miss A M Dempster,	1938 Mar 28	529	4 0	4 12	4	18	19	13	20	20	18	19	16	18	12	6	37	138	8	183	39	22 8½	2 2	(a) 1 121	—	—	Oct., *July*
		Emo Park,	,,	530	3 8	5 0	—	11	21	18	15	20	22	24	20	22	20	8	83	116	2	201	34	24 2	2 3	lb. oz dr	—	—	Oct., *July*
		Portarlington,	,,	531	3 10	4 12	—	19	14	14	16	18	20	23	23	21	21	11	106	89	5	200	31	24 0¾	2 3	(b) 152 12 14	—	—	Oct.
		Laoighis	,,	532	4 2	4 12	2	22	21	20	19	20	21	22	23	18	18	11	44	168	5	217	46	26 11¼	2 2	oz.	—	—	Oct., *July*
			,,	533	3 8	4 8	—	13	19	18	12	18	20	20	19	20	18	9	15	148	23	186	16	22 2¼	2 1	(c) 26 2	—	—	Oct.
			April 9	534	3 8	4 8	—	—	—	19	20	21	24	13	7	24	6	—	129	5	—	134	3	14 10	2 6	(d) £6 14 11	—	—	Oct., July
9	90	*White Leghorn* Rev Bro Dominick,	1938 March	499	4 6	5 2	7	13	2	—	—	17	20	23	22	22	26	13	41	110	14	165	16	18 3	2 2	(a) 1,146	2	—	Dec
		Agricultural College,	,,	500	4 4	5 8	—	4	18	15	7	21	25	24	23	20	19	10	174	12	—	186	26	21 5½	2 6	lb oz dr	—	—	Oct.
		Mountbellew,	,,	501	4 8	5 8	3	19	1	12	16	19	19	22	22	19	18	10	171	8	1	180	22	21 1¼	2 6	(b) 160 13 3	—	—	Dec., *July*
		Co Galway	,,	502	4 4	5 0	14	—	—	17	24	22	24	20	21	11	17	6	64	102	10	176	10	19 7¼	2 3	oz	—	—	Nov.
			,,	503	4 6	4 12	21	—	5	11	23	24	26	24	25	16	21	3	78	112	14	204	16	22 9½	2 3	(c) 26 9	1	—	Nov.
			,,	504	4 0	4 10	22	20	20	20	19	21	23	20	20	21	19	3	125	107	2	234	66	29 5½	2 3	(d) £6 12 9¾	—	—	*July*
				U.T.	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	1	—	1	1 12		—	—	—

D = Dead. *Disqualified under Clause 28 (more than 20 per cent second grade eggs). U.T. = Untrapped.

SECTION V—ANY NON-SITTING BREED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of test (lb. oz)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av weight per dozen (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
10	94	*White Leghorn* Mrs. M. A. Walsh, Wardstown, Athboy, Co. Meath	1938 Mar 25	523	3 8	4 2	21	19	20	18	19	20	22	22	22	21	20	11	31	137	17	235	48	29 0½	2 2	(a) 1,040	—	—	June
			April 1	524	3 9	D	—	—	16	15	12	14	21	5	—	D	—	—	55	26	2	83	17	10 7¼	2 4	lb oz. dr	—	—	Oct., Feb.
			Mar 25	525	3 8	5 0	8	22	21	19	17	23	24	23	20	26	21	10	57	160	17	234	53	28 9¾	2 2	(b) 137 1 14	1	—	Oct., *July*
			,,	526	3 8	4 4	—	18	23	21	20	21	23	23	23	21	19	10	4	154	64	222	36	26 0	2 0	oz	—	—	Oct., *July*
			,,	527	4 0	D	11	25	4D	—	—	—	—	—	—	—	—	—	7	30	3	40	37	7 1½	2 0	(c) 25 3	—	—	—
			,,	528	3 8	4 9	—	—	22	24	24	25	27	25	24	22	22	11	44	176	6	226	27	26 2½	2 2	(d) £6 7 9	—	—	Oct., *July*
11	96	*White Leghorn* Mrs M. E. Higgins, Carramarla, Claremorris, Co Mayo.	1938 April 4	535	3 8	4 6	8	25	19	22	19	16	19	18	15	14	1	—	168	8	--	176	57	23 4½	2 7	(a) 1,039	—	—	Oct., July
			Mar 30	536	3 10	5 0	13	20	15	17	18	19	22	24	22	22	16	9	54	144	19	217	33	26 4½	2 2	lb oz dr	1	—	Oct., *July*
			April 4	537	4 6	D	2	14	8	4	13	19	23	22	22	22	(2d	—	69	86	6	161	21	18 7	2 3	(b) 143 3 4	—	—	Oct.
			Mar. 26	538	3 8	4 14	—	3	21	11	—	16	22	25	23	24	23	11	7	127	45	179	18	19 9	2 0	oz	—	—	Oct., Jan , *July*
			.	539	3 12	4 4	10	11	15	8	10	19	23	18	10	15	13	5	128	26	3	157	39	19 1½	2 6	(c) 26 5	1	—	Oct., Jan., *June*
			.	540	3 12	4 8	—	—	20	18	20	22	18	20	17	14	-	—	53	90	6	149	23	17 9¼	2 3	(d) £6 4 11¾	—	—	Oct , July
12	93	*White Leghorn* Mrs. L. Burke, Santry Hall, Santry, Co Dublin	1938 April 7	517	4 1	5 4	6	21	16	—	21	18	21	21	16	16	19	4	68	96	15	179	29	21 10½	2 3	(a) 1,021	1	—	Jan , *July*
			,,	518	4 8	4 8	—	—	13	20	19	16	11	17	21	12	14	6	70	76	3	149	16	17 4¾	2 3	lb oz dr	—	—	Oct
			,,	519	4 4	5 0	6	16	13	16	17	17	22	21	22	19	19	12	42	137	21	200	19	23 9½	2 2	(b) 139 15 12	3	—	Oct., *July*
			,,	520	4 4	4 8	2	17	13	10	16	17	18	23	13	18	20	7	110	54	10	174	28	20 9¾	2 4	oz	—	—	*July*
			,,	521	4 4	5 8	9	17	15	—	—	12	17	24	24	20	14	12	60	73	31	164	11	19 2	2 2	(c) 26 3	3	—	Dec., *July*
			,,	522	4 8	6 0	12	18	16	16	15	18	14	13	16	8	6	3	130	20	5	155	45	20 1¾	2 5	(d) £6 3 2¼	--	—	*July*
*	87	*White Leghorn* Sister-in-Charge, R D E. School, Swinford, Co. Mayo	1938 Mar. 2	481	4 0	4 3	20	21	22	3	3	21	25	23	22	22	24	9	18	145	52	215	34	25 6¼	2 0	(a) 1,077	1	—	Jan.
			,,	482	3 12	4 1	—	—	--	13	21	23	26	25	9	24	21	--	1	47	114	162	—	15 1½	1 15	lb. oz dr	1	—	Oct., June, *June*
			,,	483	4 4	5 0	2	15	—	4	18	20	25	24	23	21	23	6	49	123	9	181	13	20 3¼	2 2	(b) 138 13 14	—	—	Oct.
			,,	484	3 8	4 2	3	17	16	—	7	20	24	23	13	8	9	—	5	77	58	140	13	16 0	2 0	oz	4	—	Oct., Jan.
			,,	485	3 14	4 12	—	11	19	19	18	21	24	24	21	23	20	10	166	44	-	210	34	25 0¾	2 5	(c) 24 8	1	—	Oct.
			,,	486	3 8	4 0	—	24	10	—	5	27	23	26	8	24	18	4	1	77	91	169	12	18 3¼	1 15	(d) £6 0 3½	4	—	Oct , Jan , May
†	99	*White Leghorn* Miss E. M. O'Keeffe, St. Rita's, Lakevale, Ballydesmond, Co. Cork.	1938 Mar. 20	553	3 14	D	18	21	5	12	14	16	18	2	3	3D	—	—	3	47	62	112	8	14 2¼	1 15	(a) 925	10	—	—
			,,	554	3 12	4 6	21	18	20	22	15	22	23	25	21	21	21	10	191	42	6	239	58	29 8	2 4	lb. oz dr.	—	—	*July*
			,,	555	4 2	5 0	3	23	24	23	24	25	22	23	26	14	19	8	29	170	35	234	50	28 8¼	2 1	(b) 122 7 8	3	—	Oct., *July*
			,,	556	4 2	5 2	6	22	20	22	20	24	26	22	28	23	21	10	47	186	11	244	52	29 10½	2 2	oz.	—	—	Oct., *July*
			,,	557	4 8	D	7D	—	—	—	—	—	—	—	—	—	—	—	—	1	6	7	1	10¾	1 13	(c) 25 4	—	—	—
			,,	558	3 14	3 4	—	7	19	22	20	21	—	—	—	—	—	—	1	46	42	89	22	11 8¾	2 0	(d) £5 15 0¾	—	—	Oct.

D = Dead. * Disqualified under Clause 28 (more than 20 per cent. second grade eggs). †Disqualified under Clause 28 (pen produced less than 96 eggs).

SECTION V.—ANY NON-SITTING BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival	Weight: At close of test	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov 25	Nov. 26-Dec. 23	Dec. 24-Jan 20	Jan 21-Feb 17	Feb. 18-Mar 17	Mar. 18-Apl 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
					lb. oz	lb. oz																		s d	oz dr				
		White Leghorn	1938																										
†	98	Mr T Burke,	April 7	547	3 12	4 4	16	17	—	18	16	21	25	24	23	21	21	10	189	19	4	212	31	24 11¼	2 5	(a) 935	2	—	*July*
		Santry Hall	,,	548	5 0	4 6	12	15	18	6	14	23	22	20	18	17	13	3	68	92	21	151	31	21 11¾	2 2	lb oz dr	3	—	—
		Santry,	,,	549	4 2	5 0	12	17	17	19	18	19	20	17	16	21	16	8	11	154	35	200	27	24 3¾	2 1	(b) 130 5 9	—	—	*July*
		Co Dublin	April 21	550	4 4	5 11	—	7	2	—	—	—	—	—	—	—	—	—	6	3	—	9	9	1 7¾	2 2	oz	—	—	Dec , June
			April 7	551	3 10	4 8	—	9	13	17	16	13	18	23	21	19	15	11	108	64	3	175	25	20 7¼	2 4	(c) 26 8	—	—	Oct., July
			,,	552	3 12	5 3	8	15	16	—	—	16	17	19	20	22	16	9	136	16	6	158	34	19 0¾	2 6	(d) £5 12 6½	—	—	Oct.,Jan *July*
		Ancona	1938																										
13	100	Mrs. A Lysaght,	Mar 9	463	3 10	4 0	18	16	3	18	15	21	21	23	22	18	15	10	24	139	40	203	25	23 4¼	2 1	(a) 966	—	—	—
		The Cottage,	,,	464	3 8	4 8	—	—	10	17	13	17	22	20	20	2	17	8	19	110	17	146	13	16 5¼	2 1	lb oz. dr	—	1	July, *June*
		Newmarket,	,,	465	3 12	4 4	—	13	14	14	5	19	22	11	12	12	6	1	21	93	15	129	18	15 11¼	2 2	(b) 126 2 6	—	5	Feb.
		Co Cork	,,	466	3 9	3 8	12	18	16	14	17	17	20	24	22	20	13	5	4	101	93	198	4	22 6¼	2 0	oz	2	—	*July*
			,,	467	3 8	4 3	6	17	—	—	—	20	22	21	21	12	15	5	112	26	1	139	22	16 4¼	2 5	(c) 25 1	—	1	Dec.
			,,	468	4 8	6 0	6	19	5	—	14	22	22	18	16	15	12	2	29	105	17	151	24	17 9¼	2 2	(d) £5 11 11½	—	4	Dec.,July,*June*
		White Leghorn	1938																										
†	97	Rev Bro F. Bergin,	February	541	4 8	4 13	9	10	18	6	8	13	25	26	21	21	18	11	88	91	16	195	35	23 5¾	2 3	(a) 847	1	—	—
		Our Lady of Lourdes	,,	542	5 4	6 3	8	—	—	9	21	20	22	18	21	23	20	10	103	61	8	172	3	15 8	2 5	lb oz dr	2	—	Nov , *July*
		Cahermoyle,	,,	543	4 6	D	—	—	5	17	14	8	22	2	—	—	—	—	58	8	2	68	6	8 3	2 6	(b) 120 11 15	—	—	Nov.
		Ardagh,	,,	544	4 2	D	12	—	—	17	14	20	12	17	24	20	7D	—	108	35	—	143	13	16 2¾	2 6	oz	3	—	Nov
		Co Limerick	,,	545	4 0	4 12	14	19	7	5	19	19	22	24	24	22	24	11	142	61	7	210	34	24 9¾	2 4	(c) 27 4	—	—	Dec
			,,	546	4 3	5 10	1	19	—	13	12	1	7	6	—	—	—	—	48	9	2	59	20	8 5¾	2 5	(d) £4 19 11	—	—	Dec., June

D = Dead. † Disqualified under Clause 28 (pen produced less than 960 eggs).

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—22 PENS..

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec 24-Jan. 20	Jan. 21-Feb. 17	Feb 18-Mar. 17	Mar 18-Apl. 14	Apl 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug 5 Aug 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
		Light Sussex	1938																										
1	107	Miss D. M. Place,	Mar. 10	637	5 14	7 3	23	22	22	19	19	19	21	18	19	21	18	10	109	108	14	231	53	29 3¾	2 3	(a) 1,337	—	—	*July*
		Rosemount,	Feb 7	638	5 8	6 0	21	22	22	20	20	19	19	21	20	20	20	10	167	65	2	234	70	29 9¼	2 4	lb. oz. dr.	—	—	July
		New Ross,	Mar 10	639	6 0	7 10	22	18	5	—	—	21	24	26	22	23	22	9	100	92	—	192	45	22 8	2 3	(b) 179 2 7	—	—	Dec., *July*
		Co Wexford.	Feb. 7	640	5 12	6 8	17	20	14	13	23	24	26	21	11	14	10	12	23	145	37	205	35	24 7¼	2 1	oz	—	6	June
			Mar, 10	641	5 8	5 12	18	21	22	22	22	23	25	26	25	24	23	12	40	185	38	263	63	31 10½	2 1	(c) 25 7	—	—	*July*
			Mar 15	642	5 3	6 3	23	24	20	22	21	20	23	17	14	8	14	6	76	74	62	212	12	26 5¼	2 2	(d) £8 4 9	—	1	June
		Barred Rock	1938																										
*	115	Mrs. M. A. Kelly,	Feb 4	685	5 6	5 13	24	21	21	19	18	20	24	26	24	21	24	11	6	187	60	253	45	30 5	2 0	(a) 1,365	—	—	*July*
		Carranstown,	"	686	5 8	8 1	—	22	18	18	14	24	23	17	20	25	22	10	78	130	5	213	42	26 1	2 3	lb oz dr.	—	—	Oct., *July*
		Ballivor,	"	687	5 8	7 8	9	22	16	—	7	8	19	22	27	25	23	11	61	114	14	189	44	22 11½	2 3	(b) 176 3 12	—	—	*July*
		Co Meath	Mar 4	688	5 2	5 4	24	22	4	3	19	21	24	23	25	21	22	10	2	137	79	218	30	24 6¾	2 0	oz	—	—	Dec
			"	689	5 8	6 1	27	22	19	18	9	23	26	27	26	20	18	8	3	129	111	243	41	28 0¾	2 0	(c) 24 8	—	—	Jan.
			Feb. 22	690	5 0	5 14	21	23	21	17	16	22	25	25	24	23	21	11	27	214	8	249	68	31 0	2 2	(d) £8 3 0¼	—	—	*July*
		Light Sussex	1938																										
2	110	Mrs M Roche	February	655	5 8	6 0	14	19	16	18	21	23	27	22	18	21	11	9	20	156	43	219	53	26 3	2 1	(a) 1,248	1	1	July
		Talbot Hall,	"	656	6 0	7 14	20	19	23	22	21	22	24	22	14	10	14	8	195	23	1	219	67	28 0¼	2 6	lb. oz dr	—	—	*June*
		New Ross,	"	657	5 8	5 14	22	22	20	18	18	21	25	23	21	25	22	13	2	106	142	250	68	28 3¼	1 15	(b) 166 12 7	1	—	—
		Co Wexford	"	658	5 9	6 2	26	24	20	18	13	13	11	12	11	10	9	4	77	81	13	171	62	23 1¾	2 3	oz.	—	—	*June*
			"	659	5 8	6 8	20	19	14	14	18	17	10	2	5	9	11	2	99	38	4	141	53	19 1	2 4	(c) 25.7	—	—	*June*
			"	660	5 10	6 3	14	24	21	25	24	27	24	26	25	22	11	2	52	181	15	248	65	31 2	2 2	(d) £7 16 0	—	—	*July*
		Light Sussex	1938																										
3	80	Miss E. Walsh	Feb 2	571	5 12	6 13	9	22	18	18	17	18	22	21	11	12	19	5	185	7	—	192	52	24 5	2 6	(a) 1,206	—	3	*July*
		Ballylemon Lodge,	"	572	5 8	5 4	22	22	23	23	21	26	27	26	22	19	22	11	31	188	45	264	53	32 2¼	2 1	lb oz dr.	1	—	—
		Cappagh,	"	573	6 0	6 10	21	21	—	—	15	25	23	24	20	8	19	13	50	126	13	189	40	22 2	2 2	(b) 165 7 0	—	1	Dec., June
		Co. Waterford.	Mar 6	574	5 8	4 12	2	9	19	15	16	20	19	17	—	—	2	—	57	59	3	119	34	15 3¼	2 3	oz	—	—	Oct., May
			"	575	6 0	6 3	22	25	23	25	20	23	22	20	17	20	9	6	145	86	1	232	75	30 2¼	2 4	(c) 26 3	—	1	July
			"	576	5 8	5 6	18	20	21	20	18	19	19	19	21	6	19	10	81	119	10	210	55	26 8¼	2 3	(d) £7 11 0¾	—	1	June
		Light Sussex	1938																										
4	84	Sister-in-Charge,	Feb 5	607	6 0	6 5	21	20	19	21	—	—	20	26	20	23	24	11	69	134	2	205	65	25 11¾	2 3	(a) 1,135	—	—	Jan
		Coolarne College,	Feb. 26	608	6 4	5 8	15	21	17	13	—	7	23	27	12	16	—	—	105	45	1	151	58	19 8¼	2 4	lb oz. dr	1	4	Jan.
		Athenry,	Feb. 14	609	5 12	D	17	20	20	14	12	15	18	5D	—	—	—	—	48	68	5	121	57	17 1¼	2 2	(b) 156 5 12	—	—	—
		Co Galway	Mar 10	610	5 8	6 10	24	23	24	21	4	24	25	24	13	25	0	11	156	68	3	227	73	29 1¼	2 4	oz.	—	2	Feb, *July*
			Mar. 2	611	5 14	7 6	19	22	25	23	—	—	23	28	15	23	27	11	17	184	15	216	70	27 4¼	2 1	(c) 26 5	—	1	Feb.
			Feb. 26	612	5 12	6 14	23	13	22	18	19	21	26	25	13	10	20	5	199	15	1	215	60	27 0¼	2 5	(d) £7 6 4¼	—	3	June

D.=Dead.

* Disqualified under Clause 28 (more than 20 per cent. second grade eggs).

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of test lb. oz.	Eggs Laid Oct 1–Oct. 28	Oct 29–Nov 25	Nov 26–Dec. 23	Dec 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar 17	Mar 18–Apl. 14	Apl 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
5	83	*Light Sussex* Mr G Barrett,	1938 Feb 7	589	5 10	5 12	19	3	23	6	20	15	22	15	9	12	15	10	130	39	—	169	50	21 0¾	2 4	(a) 1,130	—	5	June
		Ring,	,,	590	5 8	5 12	26	25	20	19	18	22	24	20	12	11	12	8	3	144	70	217	20	26 10¾	2 0	lb oz dr	2	3	June
		Clonakilty,	,,	591	5 9	6 0	4	23	21	18	7	10	22	21	15	13	11	12	61	111	5	177	49	22 10¼	2 2	(b) 151 13 1	—	5	Oct, Feb. June
		Co Cork.	,,	592	5 8	5 8	3	18	22	9	22	21	12	19	12	12	10	8	4	56	108	168	8	19 2	1 15	oz	2	5	Oct., June
			,,	593	5 14	6 3	26	27	25	24	23	22	25	24	14	15	13	10	173	74	1	248	83	32 4	2 4	(c) 25 8	2	2	July
			,,	594	6 2	6 4	18	—	14	21	20	21	18	10	11	4	8	6	112	37	2	151	34	18 6¼	2 5	(d) £7 0 10¼	—	3	Nov., June
6	108	*Light Sussex* Mrs. K. O'Brien,	1938 Feb. 2	643	5 8	6 0	22	21	18	18	15	19	20	16	7	13	14	5	92	95	1	188	65	24 7½	2 3	(a) 1,135	—	2	July
		Ballykilmurray,	,,	644	5 10	6 12	—	—	—	6	23	26	27	25	21	24	24	13	21	152	19	192	—	19 11½	2 1	lb oz dr	—	—	Oct
		Tullamore,	,,	645	5 8	5 12	20	17	16	17	17	15	15	21	13	13	12	3	142	37	—	179	58	23 0	2 4	(b) 151 0 15	—	3	July
		Offaly.	,,	646	5 9	6 1	18	20	20	16	18	20	19	25	19	14	14	5	156	53	2	211	60	26 8	2 4	oz	—	—	—
			,,	647	5 8	6 7	26	24	20	11	12	17	3	6	—	—	—	—	7	105	7	119	70	17 7½	2 1	(c) 25 6	—	—	*July*
			,,	648	5 11	5 8	—	12	23	23	18	25	27	26	27	25	26	14	2	100	144	246	27	26 4¼	1 15	(d) £6 18 3	—	—	Oct.
7	109	*Light Sussex* Miss M. Johnson	1938 Feb. 1	649	5 10	6 4	18	26	22	23	23	23	23	16	17	9	11	8	140	81	1	222	70	29 0	2 4	(a) 1,116	—	3	July
		Sea View,	,,	650	5 8	6 8	—	6	23	26	22	25	19	22	10	10	9	2	13	131	30	174	31	20 10¼	2 1	lb oz dr	—	—	Oct.
		Murrintown,	,,	651	5 8	6 10	19	26	22	18	19	23	21	18	11	11	11	3	45	149	8	202	69	26 6¾	2 2	(b) 151 6 0	—	—	*July*
		Co Wexford	,,	652	5 8	6 6	—	—	15	18	19	16	19	22	18	14	14	5	128	29	3	160	21	18 4¼	2 5	oz.	—	7	Oct., *July*
			,,	653	5 11	6 7	25	20	19	—	6	24	20	25	17	22	18	12	64	126	18	208	58	25 5	2 2	(c) 26 0	—	2	Dec., *July*
			,,	654	5 12	6 10	—	—	22	13	9	27	14	22	16	4	17	6	62	86	2	150	25	17 6¾	2 3	(d) £6 17 9¼	—	4	Oct, July
8	81	*Light Sussex* Sister-in-Charge,	1938 Mar 10	577	5 10	5 9	27	25	22	22	19	15	4	12	15	10	9	2	103	75	4	182	74	25 2¼	2 4	(a) 1,065	—	—	—
		St Martha's College,	---	578	5 8	5 10	26	26	23	24	23	23	24	19	19	12	14	6	28	120	91	239	3	29 3½	2 0	lb oz dr	3	2	June
		Sion,	Feb 22	579	5 9	6 7	17	20	10	18	14	11	9	8	6	—	—		103	10	—	113	51	15 10	2 6	(b) 145 10 14	1	—	June
		Navan,	Feb. 20	580	5 10	6 2	25	22	22	21	19	22	16	2	5				85	58	11	154	63	21 8½	2 3	oz	—	—	*June*
		Co Meath	Feb. 22	581	5 8	6 4	10	—	—	10	23	25	25	23	16	15	14	4	105	57	3	165	8	18 1	2 4	(c) 26.3	—	4	Nov.
			Mar 10	582	5 10	6 12	17	25	22	20	18	20	21	22	17	13	17	—	118	92	2	212	65	27 7	2 4	(d) £6 17 8¼	—	1	June
9	103	*Light Sussex* Mrs J. Hely-Hutchinson	1938 February	613	5 8	6 7	25	22	22	20	20	21	23	19	23	18	16	8	30	179	28	237	48	29 9	2 1	(a) 1,142	—	—	*July*
		Lissen Hall,	,,	614	5 14	6 13	13	—	12	16	9	18	21	21	19	20	17	8	164	9	1	174	27	20 1	2 7	lb oz dr	—	—	Nov., *July*
		Swords,	March	615	5 12	6 8	6	16	20	11	13	19	18	21	17	9	16	—	85	77	4	166	41	20 10¼	2 3	(b) 158 1 12	—	2	Oct, June
		Co Dublin.	,,	616	6 0	7 7	23	5	—	4	22	25	23	17	16	22	20	11	20	145	23	188	15	20 10	2 1	oz	—	1	Nov., Aug.
			,,	617	5 10	7 4	1	13	13	20	22	23	23	15	16	7	10	8	152	18	1	171	31	20 10¼	2 6	(c) 26 6	13	2	Oct, June
			,,	618	5 8	6 6	25	1	—	12	28	26	27	28	22	14	13	10	88	113	5	206	21	23 3¼	2 3	(d) £6 15 8	—	2	Nov., June

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of test lb oz.	Eggs Laid Oct 1-Oct. 28	Oct. 29-Nov. 25	Nov 26-Dec. 23	Dec 24-Jan 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug 4	Aug 5-Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade – Oct. 1-Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr	(a) Total Eggs from Pen. (b) Total weight (c) Av weight per dozen (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
		Barred Rock	1938																										
10	116	Mrs. N. Browne,	Feb 15	691	5 0	6 0	1	19	18	15	18	21	23	24	23	19	17	7	26	146	33	205	37	24 4	2 1	(a) 1,031	—	—	*July*
		Burrane,	"	692	5 0	5 2	25	23	22	21	19	22	24	26	19	22	20	2	99	142	4	245	74	31 1½	2 3	lb oz dr	—	—	—
		Knock,	"	693	5 2	D	21	22	22	14	10d	—	—	—	—	—	—	—	66	23	—	89	68	14 6¼	2 3	(b) 138 9 2	—	—	—
		Co. Clare	"	694	5 4	6 1	13	23	20	18	20	21	25	15	20	20	11	5	72	136	3	211	60	26 10	2 3	oz	—	2	*July*
			"	695	5 2	D	23	19	22	—	D	—	—	—	—	—	—	—	1	51	12	64	52	10 10	2 0	(c) 25 8	—	1	Jan.
			"	696	5 0	5 9	12	21	19	10	16	20	23	23	22	23	19	9	138	78	1	217	55	26 10	2 4	(d) £6 14 6¼	—	—	—
		Light Sussex	1938																										
*	111	Miss P. White,	February	601	5 8	6 4	—	15	23	25	8	22	22	17	—	25	—	9	46	111	9	166	42	21 0¼	2 2	(a) 1,079	1	2	Oct., Feb., July
		Gortnafluir,	March	602	5 12	5 12	22	21	19	18	4	4	22	9	18	2	16	—	46	91	18	155	50	20 9¼	2 2	lb oz dr.	—	2	Feb., June
		Clonmel,	"	603	5 8	6 12	—	2	23	21	22	20	20	15	13	16	5	10	117	50	—	167	29	20 5	2 4	(b) 142 0 0	—	4	Oct., June
		Co. Tipperary.	February	604	5 12	6 11	21	23	21	21	20	19	25	23	22	22	22	10	4	94	151	249	12	28 2¼	1 15	oz	—	—	*July*
			March	605	6 4	6 12	21	24	18	13	—	9	19	16	18	3	14	—	31	93	31	155	38	20 2¼	2 1	(c) 25 3	—	3	Jan., June
			February	606	5 8	6 12	15	18	—	—	13	21	24	23	23	23	19	8	82	93	12	187	22	21 4¼	2 3	(d) £6 12 1	—	—	Dec.
		Barred Rock	1938																										
11	114	Mrs. L. O'Reilly,	Mar 10	661	5 6	6 13	21	22	21	18	18	22	25	18	16	17	15	5	70	129	22	221	52	28 0¼	2 2	(a) 1,098	—	4	June
		Rodstown,	"	662	5 3	6 3	12	18	20	17	19	21	22	25	23	23	25	10	12	201	22	235	45	28 5¼	2 1	lb oz. dr	—	—	—
		Balrath,	Feb. 10	663	5 8	6 2	16	14	14	20	16	20	25	23	26	22	25	11	7	189	36	232	29	27 2¼	2 1	(b) 142 4 3	—	—	—
		Ceanannus Mor,	"	664	5 2	5 11	20	17	—	5	—	7	10	5	2	—	2	3	34	29	8	71	30	9 8½	2 3	oz	—	—	Dec., June
		Co. Meath	"	665	5 0	5 0	—	—	—	7	11	20	27	17	16	17	19	3	33	92	12	137	1	14 3	2 2	(c) 24 9	—	3	Oct., *July*
			Mar 10	666	5 3	5 6	23	20	18	12	1	20	21	22	19	19	18	9	6	104	92	202	18	23 6¼	2 0	(d) £6 11 2	—	—	*July*
		Buff Rock	1938																										
12	117	Mrs. M. A. Walshe,	Feb. 18	703	5 4	6 10	—	20	24	26	20	19	20	16	16	17	14	5	14	135	48	197	40	24 3	2 0	(a) 1,052	1	4	Oct., *June*
		Tullamore,	Feb 26	704	5 8	5 12	9	—	20	19	15	19	8	18	14	12	14	5	119	33	1	153	34	18 7½	2 5	lb. oz dr	—	5	Nov., *June*
		Listowel,	Jan 21	705	5 12	4 12	—	7	15	16	16	19	21	20	19	20	14	—	7	82	78	167	22	18 2¼	2 0	(b) 138 5 6	—	—	—
		Co. Kerry.	Feb. 18	706	5 6	5 15	18	19	16	17	14	16	—	—	—	—	—	—	25	73	2	100	57	15 0¼	2 2	oz	—	—	May
			Jan 21	707	5 14	6 12	23	26	21	23	18	19	20	25	19	17	18	9	102	125	11	238	70	30 4¼	2 3	(c) 25 2	—	—	July, *June*
			Feb 26	708	5 8	6 6	2	21	15	—	7	23	24	26	25	21	23	10	19	152	26	197	37	22 9¼	2 1	(d) £6 9 3½	—	—	Jan., *July*
		Buff Rock	1938																										
13	118	Mrs. E. Walsh,	February	709	6 4	6 8	20	20	19	20	22	19	22	20	18	15	13	2	201	9	—	210	64	26 11	2 5	(a) 1,001	—	—	—
		Jordanstown,	"	710	5 4	D	20	20	20	18	18	20	20	20	14	13	14	4D	96	102	3	201	64	25 10½	2 3	lb oz dr	—	—	July
		Buttevant,	"	711	5 10	D	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(b) 147 3 15	—	—	—
		Co. Cork.	"	712	5 12	6 0	21	22	22	19	18	22	21	17	10	11	7	1	188	3	—	191	68	25 4¼	2 7	oz	—	—	July, *June*
			"	713	6 0	6 4	21	22	17	21	20	21	18	22	15	2	23	10	209	3	—	212	65	27 2¼	2 7	(c) 28 3	—	—	July
			"	714	5 4	6 4	20	6	13	20	11	19	22	21	17	19	11	8	166	21	—	187	43	22 7¼	2 6	(d) £6 7 11½	—	5	Nov., June

D. = Dead.

* Disqualified under Clause 28 (more than 20 per cent. second grade eggs).

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
14	105	*Light Sussex*	1938																					s. d.	oz. dr.				
		Sister-in-Charge,	Feb. 23	625	6 6	6 8	7	27	24	25	24	24	24	17	12	20	18	—	81	133	8	222	59	25 8	2 2	(a) 1,065	1	2	July
		St. Mary's Abbey,	Mar. 7	626	5 14	5 5	21	22	22	19	17	22	22	22	23	21	19	10	231	9	—	240	69	30 4	2 6	lb. oz. dr.	—	—	*July*
		Glencairn,	Mar. 11	627	5 12	6 0	—		13	19	14	19	18	21	9	16	12	6	88	58	1	147	16	17 1½	2 4	(b) 152 7 5	1	1	Oct., May
		Co. Waterford	,,	628	5 8	6 0	—	—	2	8	25	25	24	26	24	23	21	9	165	22	—	187	5	20 0½	2 5	oz.	—	—	Nov., July.
			Mar. 15	629	5 9	5 4	—		2	19	19	20	22	22	20	21	20	10	167	8	—	175	6	19 2½	2 7	(c) 27 5	—	—	Nov.
			Feb. 25	630	6 6	6 2	17	2	—	—	—	13	22	14	12	6	8	—	41	45	8	94	19	10 6¼	2 3	(d) £6 5 11¼	—	4	Nov., July
*	79	*Light Sussex*	1938																										
		Mrs. M. Riordan,	February	565	5 10	6 1	—	—	11	22	20	26	23	17	18	17	—	—	53	101	3	157	18	18 5	2 3	(a) 1,045	1	1	Oct
		Glenleigh,	,,	566	5 8	6 2	22	14	15	17	11	9	19	16	9	11	11	5	1	22	136	159	1	17 9½	1 13	lb. oz. dr.	26	—	—
		Clogheen,	,,	567	5 8	6 0	16	20	—	12	22	25	25	18	13	18	17	12	46	140	12	198	33	23 5½	2 2	(b) 136 10 5	—	3	Dec., July
		Co. Tipperary	,,	568	5 10	6 2	—	—	18	24	22	27	26	27	24	20	8	12	99	108	1	208	23	24 0½	2 3	oz.	—	—	Oct., July
			,,	569	5 8	5 9	—	—	9	20	17	20	23	16	5	7	1	8	100	23	3	126	13	14 6½	2 4	(c) 25 1	—	—	Oct., July, *June*
			,,	570	5 9	5 11	—	8	26	10	25	23	24	28	17	18	14	4	4	90	103	197	12	21 7	1 15	(d) £5 19 9¼	5	4	Oct., July, *June*
*	112	*Barred Rock*	1938																										
		Mrs. J. N. Edwards,	Feb. 15	667	5 6	D	20	20	1	14	14	4	21	13	D	—	—		98	9	—	107	41	14 5½	2 4	(a) 1,000	—	—	—
		Hillsboro' House	,,	668	5 6	6 0	14	20	15	9	16	17	19	21	17	12	7	—	8	97	62	167	30	19 11½	2 0	lb. oz. dr.	3	—	*July*
		Ramelton,	,,	669	5 8	6 3	17	18	18	7	17	21	24	26	24	24	21	10	1	54	175	230	24	24 3½	1 14	(b) 131 8 12	2	—	*July*
		Co. Donegal	,,	670	5 4	5 5	3	24	26	8	9	27	12	21	15	16	9	6	145	31	—	176	59	22 7	2 5	oz.	—	6	Oct., July
			,,	671	5 8	6 11	13	1	22	15	16	19	18	18	13	15	11	10	9	113	49	171	35	19 9½	2 0	(c) 25 3	—	—	Oct., *July*
			,,	672	5 4	6 6	22	24	2	—	—	15	18	19	13	12	11	13	125	23	1	149	48	18 7	2 5	(d) £5 19 8¼	—	4	Dec
†	82	*Light Sussex*	1938																										
		Mrs. L. Hastings,	March	583	5 12	6 9	—	7	18	5	17	18	21	13	13	11	13	2	42	85	11	138	19	16 5¼	2 2	(a) 938	—	2	Oct., June
		Friarstown House,	,,	584	5 8	6 4	9	15	8	—	18	18	13	14	4	17	3	6	66	56	3	125	29	15 7¼	2 3	lb. oz. dr.	—	3	Oct., Dec., June, *June*
		Limerick	Feb. 25	585	6 4	6 1	24	20	19	18	21	22	23	13	22	17	11	8	192	25	1	218	65	27 10¼	2 5	(b) 129 10 0	—	—	*July*
				586	5 8	D	20	23	20	20	26	21	17	19	13	15	14	25	198	5	1	204	66	26 7¼	2 7	oz.	—	—	—
			,,	587	5 0	5 2	13	—	—	—	6	11	19	18	15	12	18	7	6	70	43	119	3	11 11¼	2 0	(c) 26 5	—	2	Nov., Aug
			March	588	[illegible] 12	5 14	18	22	21	7		12	17	2	15	14	4	2	7	80	47	134	22	17 7	2 0	(d) £5 16 0¼	—	5	Jan., June
†	104	*Light Sussex*	1938																										
		Mrs. M. Keatley	Jan. 20	619	5 14	6 12	17	15	—	12	20	25	10	15	5	15	20	—	14	121	19	154	19	18 6	2 1	(a) 920	—	5	Dec., June, *June*
		Boakfield,	,,	620	5 10	7 1	7	—	3	22	12	22	14	17	17	15	14	4	9	108	30	147	11	15 11¼	2 0	lb. oz. dr.	—	4	Nov., July
		Ballytore,	,,	621	[illegible]	6 10	10	10	15	9	20	18	14	14	12	16	12	—	32	115	3	150	34	18 8¼	2 2	(b) 122 2 2	—	10	Nov., June, *June*
		Co. Kildare.	Feb. 5	622	5 11	7 4	7	18	12	19	9	16	20	14	13	13	13	1	108	47	—	155	42	19 8	2 4	oz.	1	7	July
			,,	623	5 12	7 7	16	20	21	19	18	19	15	13	12	8	6	11	93	79	6	178	57	23 5	2 3	(c) 25 5	—	4	July, *June*
			Mar. 15	624	5 8	6 7	—	5	22	13	—	24	17	13	9	12	12	9	12	111	13	136	27	16 4¼	2 1	(d) £5 12 8	—	6	Oct., Jan., *July*

D. = Dead. * Disqualified under Clause 28 (more than 20 per cent. second grade eggs). † Disqualified under Clause 28 (pen produced less than 960 eggs)

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival	Weight: At close of test	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov 26-Dec. 23	Dec. 21-Jan. 20	Jan 21-Feb. 17	Feb. 18-Mar. 17	Mar 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8 Aug 4	Aug. 5-Aug 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen (b) Total weight (c) Av. weight per dozen. (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
					lb. oz	lb. oz.																		s d	oz dr				
		Barred Rock	1938																										
*†‡	113	Mrs E. A. Henderson,	Mar 14	673	5 4	5 12	2	22	21	22	20	23	24	24	25	24	24	3	1	113	120	234	13	26 5	1 15	(a) 862	3	1	*July*
		Ardrum,	,,	674	6 0	7 4	—	6	4	8	20	18	20	24	25	19	21	10	41	124	10	175	6	19 3	2 2	lb oz dr	—	—	Nov
		Inniscarra,	,,	675	5 2	D	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			(b) 106 8 10	—	—	—
		Co Cork.	Feb. 24	676	5 8	5 15	—	7	—	—	—	—	18	27	23	23	4	—	—	25	77	102	4	9 3¼	1 15	oz	—	—	Jan
			Mar 14	677	6 1	6 11	4	—	19	20	18	21	20	25	15	16	21	1	11	117	52	180	7	20 1¾	2 0	(c) 23 7	—	3	*July*
			Mar. 25	678	5 10	5 13	—	20	19	8	11	15	21	17	16	19	18	7	—	11	160	171	2	17 11	1 14	(d) £4 13 0	10	—	—
		Light Sussex	1938																										
*†	106	Miss U Roche,	Feb. 24	631	5 8	7 8	20	18	—	20	21	22	15	20	16	11	18	3	69	103	12	184	31	22 3½	2 2	(a) 688	—	3	Nov., *July*
		Creevaghbeg.	,,	632	5 9	6 10	9	—	21	19	20	19	19	11	18	10	8	2	16	125	15	156	27	18 10¾	2 1	lb oz dr	—	1	Nov., *July*
		Ballymahon,	,,	633	5 8	5 15	19	15	—	—	—	14	24	21	6	11	—	3	—	29	87	116	3	12 2¼	1 14	(b) 88 0 5	2	4	Dec., *July*
		Co. Longford	,,	634	5 10	6 1	20	—	—	—	—	8	22	14	13	2	16	7	1	46	55	102	—	10 3½	1 15	oz	2	4	Nov, June
			,,	635	5 8	5 10	19	—	—	9	20	17	22	11	—	16	14	—	29	87	12	128	8	14 5	2 2	(c) 24 6	—	3	Nov.
			,,	636	5 11	D	2D	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	3	1 12	(d) £3 18 4	—	1	—

D = Dead   * Disqualified under Clause 28 (more than 20 per cent second grade eggs)   † Disqualified under Clause 25 (pen produced less than 960 eggs).

‡ Disqualified under Clause 25 (eggs failed to reach the standard weight of 24 oz per dozen)

NOTES AND MEMORANDA.

ANNUAL CONGRESS OF THE NATIONAL VETERINARY MEDICAL ASSOCIATION, 1939.

The Annual Congress of the National Veterinary Medical Association, which was held at Great Yarmouth from the 23rd to the 28th July, 1939, was attended by Mr. J. H. Norris, M.R.C.V.S., Chief Veterinary Officer, as official delegate from the Department of Agriculture. The large attendance at the Congress included several Irish members of the Association.

The Congress sessions were held in the Town Hall, and on the opening day the Mayor of Great Yarmouth extended a civic welcome to the members and visitors. On the evening of the same day a civic reception was given by the Mayor and Mayoress.

The subjects discussed at the Congress were of exceptional interest and importance. The papers read included :—

(1) " Causes of Deaths among Calves in Dairy Herds " by R. Lovell, Ph.D., M.Sc., M.R.C.V.S., D.V.S.M. (Vict.), Royal Veterinary College, London.

(2) " Sterility in the Mare associated with Irregularities of the Oestrous Cycle" by F. T. Day, M.R.C.V.S., School of Agriculture, Cambridge.

(3) " Physiological Aspects of Bovine Sterility " by John Hammond, M.A., Hon. D.Sc. (Iowa), F.R.S., School of Agriculture, Cambridge.
The discussion on this paper was opened by Professor J. A. Nicholson, Ph.D., M.A., M.R.C.V.S., of the Veterinary College, Dublin.

(4) " Diseases of the Digestive System of Young Pigs " by Professor Dr. R. Manninger of the Royal Hungarian Palatin-Joseph University, Budapest.
Professor W. Kearney, M.R.C.V.S., of the Veterinary College, Dublin, was one of the opening speakers in the discussion on this paper.

(5) " Recent Advances in our Knowledge of Diseases associated with Mineral Balance in the Blood of Ruminants " by H. H. Green, D.Sc., Sc.D., of the Weybridge Laboratory.

(6) " Joint-Ill (Polyarthritis) of Lambs in East Anglia " by F. Blakemore, M.R.C.V.S., D.V.S.M., Institute of Animal Pathology, Cambridge.

(7) " Recent Advances in Therapeutic Agents for Veterinary Use " by Professor G. F. Boddie, B.Sc., M.R.C.V.S., Royal (Dick) Veterinary College, Edinburgh.

The discussions on all the papers were well maintained and were of great interest to the members present.

The section of the proceedings devoted to demonstrations and exhibits proved a valuable feature of the Congress. On the 25th July, demonstrations in *post-mortem* technique were given on a cow, a pig, a dog and a fowl, at the premises of Mr. William Shipley, M.R.C.V.S., Southtown, Great Yarmouth. The exhibits on view throughout the period of the Congress included plants poisonous to animals, morbid specimens, surgical and other instruments, and fittings for the protection of animals against gas warfare.

SEVENTH INTERNATIONAL CONGRESS OF GENETICS.

The Seventh International Congress of Genetics, which was held at the Animal Genetics Institute, Edinburgh, from the 23rd to the 29th August, 1939, was attended by Mr. R. Lynch, A.R.C.Sc.I., and Mr. J. J. Brady, M. Agr. Sc., as official delegates from the Department of Agriculture. The Congress was organised by the Committee of the Genetical Society of Great Britain, the General Secretary being Professor F. A. E. Crew, Director of the Animal Genetics Institute, Edinburgh. The proceedings were divided into a number of sections concerned with various aspects of genetics, and particular prominence was given to the sections dealing with the application of genetics in live stock breeding and plant breeding.

At a plenary session on the 23rd August, addresses of welcome were delivered by representatives of the civic and university authorities, and on the evening of the 25th August the members of the Congress were welcomed on behalf of the Government of the United Kingdom at a reception in the Royal Scottish Academy Galleries.

On the opening days the attendance totalled about 500, comprising delegates from some 30 countries, but, in view of the developments in the international situation, numbers of delegates left Edinburgh before the conclusion of the Congress.

In the animal-breeding section of the programme, the main subjects dealt with included Inheritance of Milk Yield and Artificial Insemination.

As regards milk yield, the papers read stressed the importance of the progeny test, with the proviso that allowance should be made for changes in environmental conditions. A very interesting paper was contributed by Lord Rowallan from the standpoint of a practical breeder: the writer gave particulars of his experience with his pedigree Ayrshire herds and stated that his objective was the breeding of dairy cows which would give a practically uniform quantity of milk throughout their lactation period. He emphasised the fact that Ayrshire breeders who aimed at success in the showyard tended to breed an animal which lacked "persistency" in lactation.

Particulars were given of the progress made in several countries in the use of artificial insemination mainly in the case of cattle. It was stated that in Kenya some 12,000 cows were artificially inseminated each year, and the advocates of the method claimed that, as it is designed to make good sires available to an increased number of females, it is especially adapted for use in partially-settled countries where the number of such sires is relatively small. It is also claimed that this method would prevent the spread of diseases of the genital organs and would counteract sterility. Evidence was not forthcoming, however, as to whether the progeny resulting from this method of reproduction would themselves produce normal progeny if the method were continued for some generations.

Every aspect of genetical work in relation to plant improvement was touched on in the papers read in the sections of the Congress devoted to cytology, plant breeding, gene and chromosome theory, and statistical genetics. A number of speakers gave interesting accounts of the efforts being made in various countries to combine resistance to specific diseases with other desirable plant characters. In the case of cereal smuts and rusts, a good deal of work on these lines has been done in the U.S.A. and it has been found practicable, using the backcross method, to transfer to commercial stocks of the more widely-grown varieties the high resistance to Black Stem Rust and Bunt which is characteristic of some less popular varieties.

Reference was also made to Canadian attempts to produce a perennial wheat. Numbers of Agropyron-Triticum hybrids have been produced, but the main barrier to progress in this work is stated to be the high degree of sterility found in those plants which exhibit the perennial character.

On the 28th August a number of the Congress delegates visited the Scottish Plant Breeding Station at Corstorphine for the purpose of seeing something of the breeding work which is being carried out there with oats, barley, potatoes, swedes, kales and herbage plants. In the case of potatoes, the main aim is the production of new economic varieties possessing a high degree of resistance to blight and virus diseases, and some promising results have been obtained.

During the period of the Congress, delegates were afforded an opportunity of visiting the Hannah Dairy Research Institute; Lord Rowallan's farm near Kilmarnock; the farm at Shothead managed by the Institute of Animal Genetics of the University of Edinburgh and the Auchincruive farm of the West of Scotland Agricultural College. On the 28th August delegates from the countries concerned met at the Imperial Bureau of Animal Genetics, Edinburgh, for the purpose of discussing the work of the Bureau.

OUTPUT OF TURF IN DENMARK.

The total output of turf from Danish bogs in 1938 was 1,080 million sods of which 360 millions were machine-made and 720 millions hand-made by the old-fashioned method. Production was about 10 per cent. less than in 1937. The demand for turf was also slightly smaller than in the previous year and considerable quantities were still unsold in some districts in the autumn. Elsewhere stocks sold rapidly. Special difficulties were encountered in Jutland owing to competition from German lignite briquettes of which 142,800 tons were imported in the first eleven months of 1938, an increase of over 22,500 tons on the same period in 1937. This competition from lignite blocks cannot be due to price conditions, but must be ascribed to the willingness of consumers to pay more for the nice appearance and small dust content of the briquettes.

Peat litter and peat mould are being increasingly manufactured in Denmark. During the year a new factory was started which turned out 155,000 bales. The demand for peat for insulation purposes was smaller than usual owing to the partial cessation of building activity, but its sale for gardening, poultry houses and other purposes has been on the increase.

NORWAY PERMITS IMPORTATION OF GLASS-HOUSE TOMATOES FROM HOLLAND.

In view of the continual advance of the Colorado beetle across Europe, the Norwegian Government (in a Decree dated 21st April, 1939) added Holland, Germany, and Switzerland to the list of countries from which the importation of living plants into Norway was prohibited. Plants, bulbs, onions, and tomatoes might, however, be imported if sent in new packing and accompanied by a certificate stating that, within the past ten years, Colorado beetle had not been found within 50 kilometres of the place where the plants were grown or the produce packed.

An important concession has since been made in regard to Dutch tomatoes grown under glass. These may now be imported into Norway provided each consignment is officially sealed and is accompanied by a certificate stating that the tomatoes were grown under glass, that the consignment

has been inspected and found free from Colorado beetle, and that the tomatoes have been packed in new packing material which has not been previously used.

PRODUCTION OF CASEIN IN JAPAN.

According to a recent report, Japan's monthly production of casein is only about 25 tons, of which 20 tons is milk casein and about 5 tons soya bean casein, but a big increase in production (especially of soya bean casein) is expected in the future. It is anticipated that the output of milk casein will be increased by 60 tons a month, and that of soya bean casein by no less than 200 tons a month. The Japanese Ministry of Industry and Commerce desires to encourage the production of soya bean casein in order that it may ultimately replace milk casein. With this in view, import restrictions on casein are to be enforced. Japan imported some 3,640 tons of casein in 1938, and about 6,830 tons in the previous year. The bulk of this imported casein comes from Argentine, New Zealand and France.

ONION DISEASE IN HOLLAND.

In the autumn of 1938, the onion crop in several parts of Holland was severely attacked by a disease which is popularly known as "head rot." In several instances, from 30 to 50 per cent. of the onions had to be rejected before the crop could be approved for export. An official inquiry was held at the request of the Onion Growers' Federation and a report on the outbreak is being prepared. Meanwhile, the following particulars have been published in the agricultural press.

Laboratory tests revealed that the rot, whether in the neck of the bulb ("head rot") or in the basal plate ("root mould") is due to the fungus *Botrytis allii* Munn.

Previous bad outbreaks occurred in Holland in 1928 and 1929; since then, the disease (though not wholly absent) has not caused the serious losses sustained in the "head rot years."

It is thought that the great susceptibility of the 1938 onion crop may have been partly due to the weather experienced that year during the period of growth. A cold spell followed by drought checked the plants at first, but ample rain combined with great heat followed and caused rapid and prolonged growth, with the result that from what was at first a backward crop a very heavy yield was obtained. Growth must therefore have been very rapid and the plants did not mature properly or else, after a period of poor growth, they began to grow again at the end of the season. Thus, as

harvest time approached, the neck portion had not ripened off properly, and weather during the curing period was not good enough to dry half-matured foliage quickly

Other factors may also have contributed. From inquiries made among the growers, it appeared that plants which had formed flowers were more susceptible than others. It has also been noted that crops which, during the dry period, had received a little sprinkling of rain now and then mostly escaped infection, whereas those which had had no rain were badly attacked. This would seem to support the view of some growers who like to see their onions get an occasional slight shower when spread out on the ground. The more closely the dry scales adhere to the bulb, the better the keeping quality of the onion. The question as to why a slight shower of rain should have this good effect needs further inquiry.

Meanwhile, Dutch growers are advised that the only proper course is to bury all rotten onions deep in the ground.

THE LIME PROBLEM IN GERMANY.

Recent inquiry has revealed the startling fact that 81.4 per cent. of all soils in Germany are more or less deficient in lime, and 35 per cent. are so poor in lime as to preclude the raising of maximum crops even when all other growth factors may be described as optimum.

Whilst the present-day consumption of fertilizers nitrogen, potash, and sulphuric acid—is now considerably greater than it was in the period preceding the World War (1914-18), that of lime is now actually below the pre-war figure. Of the total outlay on fertilizers, 47 per cent. is for nitrogen, and only 6 per cent. for lime.

An estimate made in 1939 of the needs of German agriculture in respect of fertilizers showed that the national requirements were approximately as follows :—

Nitrogen	1,140,000 tons.
Phosphoric Acid	1,001,000 ,,
Potash	1,813,000 ,,
Lime	19,600,000 ,,

These needs have been actually satisfied to the following extent :—nitrogen 53.8 per cent., phosphoric acid 56 per cent., potash 62.9 per cent., and lime 10.3 per cent.

The urgent need for additional supplies of agricultural lime is fully realised by the Government of the Reich and has been the subject of repeated warnings by the authorities. Notwithstanding this, the quantity of lime consumed declined by 8.28 per cent. and that of marl by 14.84 per cent. between July, 1938, and March, 1939, as compared with the previous year.

The task of supplying lime has been attended with considerable difficulty in Germany. A Lime Syndicate created in January, 1938, for the express purpose of dealing with the problem of supply has not been entirely successful. Difficulties have arisen owing to shortage of labour and of rolling stock, and also because of the constant bursting of lime-kilns. As a result of these and possibly of other causes, consignments of burnt lime either have not arrived at their destination at all, or have come too late to be of any use.

All these factors have contributed to the present serious situation :—on the one hand, a " Use more Lime " campaign and on the other, a combination of circumstances which must inevitably reduce the amount of lime consumed. The problem is regarded as lying beyond the power and scope of agriculture to handle and the view is expressed that only when the Lime Syndicate and the various local authorities get together and come to the relief of the farmer with an efficient scheme of lime distribution, will it be possible for German agriculture to achieve the results which the nation expects of it.

STATE OF THE DANISH POULTRY INDUSTRY.

In the course of a recent report, the Danish Government's chief adviser on poultry matters mentioned that, although good work had already been done for the improvement of the industry, there was still much room for improvement in certain respects. For one thing, the average number of eggs laid per hen in Denmark should be greater than it actually is. This, he thought, might be achieved partly by utilising more fully the excellent breeding stock now available, and partly by improving the breeding stock kept at the distributing stations for day-old chicks. In this connection, he said, a lesson might be learned from Holland, where the hatching of chicks may only take place during a specified period, and where the average number of eggs laid per hen has been considerably increased in a relatively short space of time by a system of public control of the breeding stock used. Other countries too have taken steps to distribute better breeding stock to poultry keepers, and in Denmark, the Ministry of Agriculture may, under the terms of the Egg Law of 1939, take steps to supervise the production of eggs for hatching.

Though artificial hatching is general in Denmark, there are a few places where a number of old hens are still kept. These hens are highly unprofitable because they lay not only too few eggs, but also in some cases too large eggs which are quite unsuitable for the market, being hard to dispose of.

Another matter which needs attention is the number of cocks kept in Denmark. This is said to be still excessive and the ordinary poultry-keeper is advised to produce only infertile eggs. Where cocks are necessary, they should be of the best possible pedigree, and should be kept apart from the flock except in the breeding season.

The report also speaks with approval of the work which is being done in Northern Ireland by Poultry Instructors who go from farm to farm correcting faults, giving advice as to the right way to handle eggs, and pointing out the need for supplying the market with eggs which are frequently gathered, unwashed, and non-fertile. Similar measures have now been adopted in Denmark where the staff of poultry advisers has been increased.

The quality of Danish table poultry is also showing improvement, and good progress has been made in marketing methods. For a number of years past, Danish turkeys have been in demand for the export trade, and the birds have been becoming steadily plumper, and more fleshy on breast and sides. In this connection, the report points to the wonderful degree of standardisation that has been achieved in the turkey industry in the United States where a typical bird, of medium weight and answering to the market's requirements, has been evolved.

"PROSPERITY FOLLOWS THE KERRY COW."

Under this title the Palestine Gazette publishes some interesting particulars about the introduction of Kerry cattle into Palestine and the success which has attended the experiment.

The modern dairy industry in Palestine has developed so rapidly in the past 20 years that its importance in the national economy is now second only to that of the citrus fruits industry. The influx of settlers and the growth of new towns and cities created an increasing demand for fresh milk. To meet this demand, heavy-milking cows of the Friesian breed were introduced in considerable numbers. In the light of subsequent developments, the wisdom of this step has been questioned.

By the spring of 1936, the market for fresh milk had become saturated. The price to the producer had fallen by about 10 per cent., while the cost of feeding stuffs was rising. The result has been a crisis in the dairy industry and it is now cheaper to import butter than to make it at home. Owing to the almost complete lack of natural pasture, necessitating the purchase or production of feeding stuffs, the cost of making butter in Palestine is said to be nearly three times what it is in the principal butter-producing countries.

Expenditure on feeding stuffs is indeed by far the biggest item in the cost of milk production. Heavy outlay is incurred in growing, under irrigation, the necessary supplies of hay, green food. roots and silage. In the circumstances, Palestinian farmers realise that they simply cannot afford to keep large cows, and the Government Veterinary Service have been directing attention to the peculiar merits of the Kerry cow. Small and hardy, a good milker and a moderate eater, she represents a saving in maintenance costs of something like 30 per cent. as compared with the bigger breeds.

A small Kerry herd was established at the Government Stock Farm at Acre in September, 1934. The health of this herd, which numbers 12 head, has been excellent during the past five years, and the cows have calved regularly. Records for eight cows, during 13 lactations, show the following averages :—total milk yield 691 gallons, fat content 4 per cent., and duration of lactation 368 days. The services of Kerry bulls from the Government Stock Farm have been placed at the disposal of cow-keepers in several districts, and the progeny of the first cross with local and Lebanese cows show a considerable improvement in conformation as well as a marked increase in milk yields.

STEM-ROT IN TOMATOES: GERMAN INQUIRY.

An extensive inquiry into the biology and control of tomato stem-rot (*Didymella lycopersici*) has been carried out by the biological Institute at Aschersleben. The investigations showed that neither ascopores nor perithecia of Didymella could be found on parts of plants which had passed the winter under normal conditions, nor did they occur on synthetic media kept for long periods at temperatures lower than 0°C. The pycnidia (*Ascochytæ lycopersici*) which occurred most frequently are, on the contrary, of the utmost significance in spreading the disease.

Field examinations showed that the disease assumes two forms: (*a*) a primary attack (from the soil) on the base of the stem, and (*b*) a secondary attack (infection from flying spores) on the terminal bud, leaf stems and axils. The fruits were often infected, even on light soils where stem-rot did not attack the growing parts of the plant. The skin of the seeds was penetrated by the mycelium, and infection may be propagated in the soil through the agency of the seed. Older plants are more susceptible than young plants; the disease nearly always appears after planting out. Diseased seed rarely produces diseased plants, though its germination capacity may be lowered.

Simultaneous culture on agar media showed that the optimum temperature of the spread of mycelium was between 16 and 20°C. A temperature of

31.8°C stops growth completely. The thermal death-point for pycnospores is 5 minutes' steady exposure to temperatures between 44 and 48°C.

Agar cultures buried in sandy soil were killed by the natural warming of the soil. The temperature of sandy soil often exceeds the maximum for the fungus, an important factor in connection with the absence of the disease on light soils. Prolonged exposure to cold (–20°C) does not reduce the viability of the fungus, which may penetrate the soil to a depth of 5 cm. It forms thick mats of mycelium when planted on nutrient media, particularly when tomato plant extract has been added. The germination of spores in distilled water is irregular, but reaches its optimum when tomato juice is added.

Control measures.—The toxic action of even the weakest solutions of sublimate, Ceresan, and Uspulun is unimpaired by the addition of tomato juice, whereas the toxic quality of weak solutions of copper sulphate was removed by adding tomato juice.

In spite of the sensitiveness of pycnospores to fungicides, the chemical control of stem-rot presents certain difficulties. In field cultivation, success was achieved only by watering with 0.1 per cent. sublimate solution, and disinfection of the supporting stakes with 1 per cent. formaldehyde solution. In greenhouse culture, promotion of the growth of adventitious roots (earthing up with disinfected soil) delayed the dying-off of the attacked plants. Painting the base of the stem with 3 per cent. Ceresan or Uspulun paste was successful in infection tests.

Stem-rot occurs chiefly on heavy soils where plentiful dressings of fresh organic manures have been given. Reducing the manurial dressing, and avoiding the direct use of fresh dung mitigates the severity of the attack; the presence of organic particles in the soil promotes the saprophytic growth of the fungus, and rich manuring overfeeds the tomato plants, making them more susceptible. Infection experiments with 108 cultivated varieties, both under glass and in the open, showed varying degrees of susceptibility, but in no case immunity.

BREEDING SPRING WHEATS IN SWEDEN.

The Annual Report for 1938 of the Swedish Seed Association contains some account of the work done in improving spring wheats and in breeding new varieties. The Association has been working on these problems for many years. Special attention is given to increasing yield capacity combined with early maturity, strength of straw, and good baking quality. In view of the great importance of the quality factor, crossings have been largely based upon Kolben spring wheat, but other foreign varieties have also been used extensively as improvers. Many crosses of spring and autumn wheats have been carried out, chiefly with the object of increasing yield capacity.

Amongst the improved varieties obtained, mention must be made of No. 01025, Diamant II, which embodies an excellent combination of the early maturity and high crude protein content of the old Diamant spring wheat, with the high yield and better gluten quality of Extra-Kolben. It was sowed towards the middle and end of April, under favourable conditions. It developed evenly and nicely during the entire period of growth and produced no " lodged " grain. Yellow and brown rusts occurred but rarely, but black rust was found, especially on some material which was sowed late. Some susceptible varieties in the spring wheat series showed attacks of brown spot disease (*Bacterium translucens undulosum*).

Most varieties grown on the experimental plots matured about the middle of August. Yields were good, amounting to 31.5 cwts. per acre in the case of Sv. 35/382 (Extra Kolben x Fylgia). Fylgia yielded 31.3 cwts. per acre and Diamant II yielded 88 lb. per acre more than Diamant I. Variety No. 01029 gave slightly over 31.4 cwts. per acre. The weight of grain per bushel averaged 64.14 lb.

CONTENTS

PAGE

THE IMPORTANCE OF ENSILAGE.

Broadcast from Radio Eireann on Monday, 15th July, 1940

BY

THE MINISTER FOR AGRICULTURE.

I had an opportunity in October last of making a broadcast appeal to farmers to produce more home-grown foodstuffs, firstly to provide for the needs of our people and, secondly, to maintain our flocks and herds. I am glad to say that farmers have responded very well to that appeal, and I feel satisfied that, given favourable harvest conditions, we shall be much less dependent on imported feeding stuffs during the coming winter than in previous seasons. The present sowing season is at an end so far as the main tillage crops are concerned but much can still be done through the medium of catch crops to increase the supply of cattle feeding stuffs.

Unfortunately there will be a scarcity of seed of certain catch crops and these must, so far as possible, be replaced by others. Suitable advice on the matter will be given by my Department.

During the next few months, however, it will be possible to add to the stocks of animal feeding stuffs already in sight by converting aftergrass into silage and it is with a view to urging the adoption of this simple method that I speak to you this evening.

The desirability of making silage for stock feeding in the coming winter has been stressed so often and so thoroughly in recent months that it may seem almost superfluous to refer to it once more. I expect and believe that everyone of you who is listening to me this evening realises the gravity of the position in regard to supplies of feeding stuffs. No matter how events may shape themselves in the meantime, and no matter what action the Government may take, one thing is obvious to everyone, namely, that circumstances will force us in the coming winter to rely more than ever before on our own resources in the matter of feeding stuffs. The problem before every farmer, therefore, is that of replacing, with the produce of his own farm, the greater part of the imported concentrated feeding stuffs which would be used in more normal times. So far as cattle feeding is concerned, this problem presents no serious difficulty if farmers are prepared to adopt the means at their own disposal.

There can be few farmers in this country at present who are not aware

that good silage is a complete food for cattle, whether for the production of milk or beef, or for maintaining store cattle in good growing condition. The farmer who has good silage for winter feeding is largely independent of concentrated feeding stuffs so far as his cattle are concerned.

In the early part of this year every possible effort was made to induce farmers to make silage from spring grass. Information was made available through the Agricultural Instructors or direct from the Department of Agriculture as to the most suitable types of silos and the proper method of making silage. Many County Committees of Agriculture gave subsidies to assist farmers in meeting the expense of erecting silos. All County Committees of Agriculture provided moulds for making concrete blocks for the erection of circular silos. For those farmers whose financial resources were limited the Department of Agriculture provided, at a moderate rate of interest, a loan sufficient to cover the entire cost of erecting a silo. Firms in this country have put on the market concrete portable silos which can be relied upon to give good results and will be found convenient by those who require silos which they can set up on a different site each year, or who have not the time or facilities for constructing permanent silos.

While many farmers have already made sufficient silage for their stock in the coming winter it is to be feared that the majority of farmers have not taken any such action and are hoping that they will by some means get over the difficulties caused by the present situation.

A number of farmers whose circumstances made it inconvenient for them to make silage from spring grass have already made the necessary arrangements to utilise aftergrass for this purpose. The wisdom of this provision cannot be over-emphasised and I would wish to impress as strongly as possible on all farmers who have not so far made silage the necessity for doing so from aftergrass.

The drought in June somewhat retarded the growth of aftergrass but our climate seldom fails us in this respect and we have now had sufficient rain to stimulate growth. In order to obtain a heavy crop of soft herbage, which makes the best silage, all the land being reserved for this purpose should be given a dressing of Sulphate of Ammonia or Nitrate of Soda at the rate of 1 cwt. per statute acre. The manure should be applied as soon as possible after the hay crop has been cut and gathered. There is then sufficient time before cutting the grass to build the silo. The question, therefore, which each one should ask himself is not " Should I make silage ? " but " How much silage should I make ?" The answer to this question depends upon the amount of aftergrass available and the numbers of cattle to be fed. One statute acre of moderate aftergrass will yield 4 tons of silage which would be sufficient, with the addition of small quantities of other foods, to provide sufficient keep for 5 months for one cow. Most farmers will, of course, feed

hay and roots and probably some other home-grown foods to their cattle in winter. The silage should be relied upon mainly as a means of replacing purchased concentrates. Six pounds of good silage is equal in feeding value to 1 lb. of mixed meals. Twenty-eight pounds of silage per cow per day, together with the other foods available, would be a reasonable allowance and would ensure that the cattle would be well nourished throughout the winter. This amount of silage would be obtained by ensiling the aftergrass from approximately one statute acre for every two cows in the herd. For fattening cattle a somewhat similar allowance to that suggested for dairy cows may be reckoned and I might perhaps mention that cattle can be fattened on silage alone. Some farmers, in fact, fatten their cattle by giving them silage on grass.

To produce the best silage the aftergrass should be cut while it is still young and in leafy condition. In the case of new or recently established meadows which contain a good deal of red clover early cutting is of particular importance as the clover tends to become hard and woody at an early stage.

I have already mentioned that good grass silage as a feeding stuff is equal to one-sixth of its weight of a properly balanced meal mixture. Just reflect for a moment what this really means. From one acre of aftergrass you will get an average of 4 tons of silage which is equivalent to about 13 cwt. of meal. The price of meal at present is £12 or £14 per ton. Can you put your land, from which you have cut a crop of hay, to any other use which will give you a return of £8 to £9 per statute acre in a couple of months? The only outlay which you have, apart from the cost of making the silage, is 11s. to 12s. per acre for the manure.

It is not my intention to go into the matter of detailed directions which might be essential for farmers who have little or no experience of silage making. You can get all the information you require on this subject from your Agricultural Instructor or direct from the Department of Agriculture.

To sum up my remarks I would strongly advise every farmer, so far as his circumstances permit, if he has not already made silage to arrange at once to make silage from aftergrass.

Make one acre of silage for every two cows or proportionately for other classes of animals in your herd.

Dress the land as soon as the hay crop is saved with one cwt. of Sulphate of Ammonia or Nitrate of Soda per statute acre.

Provide proper silo accommodation and cut the grass in leafy condition. If you find it impossible to erect a silo make the silage in a stack or clamp and remember you are not dependent on good weather to ensure good silage.

FOOD PRODUCTION IN THE EMERGENCY.

A very considerable number of special leaflets and announcements have been issued by the Department to farmers on matters relating to food production since the outbreak of the War in September, 1939. Among these publications are the following :—

Increased Food Production in Congested Districts.
(issued in December, 1939).

Imported feeding stuffs will be scarce and dear during the present emergency. It is, therefore, imperative that increased home production of farm crops should be arranged for in the coming season. This is essential in order that food may be available for the people and for the maintenance of live stock. The Compulsory Tillage Order applies to all holdings comprising 10 or more statute acres of arable land and, subject to certain exceptions, the occupier of every such holding will require to have one-eighth of the arable land in cultivation in 1940, whether or not any part of the arable land was tilled in 1939. It is recognised, of course, that this Order will not apply to the great majority of holdings in Congested Areas. It is hoped however, that in the present circumstances farmers will do their utmost to increase the present acreage of tillage on their holdings.

Potatoes :—This is one of the most important crops that can be grown on any farm, especially on a small holding. Preparations should be made without delay for all preliminary work. The potato yields this season have been satisfactory. Owing to scarcity of imported feeding stuffs, there has been a tendency in some areas to use large quantities of potatoes for stock feeding. Care should be taken, however, that sufficient seed of suitable varieties is retained for planting increased areas in the coming Spring. During the next few months, potatoes should be well protected against frost, frequently examined and any diseased tubers removed. Sprouting the seed will increase the yield considerably.

Oats :—The yield of the oat crop this year has generally been satisfactory and where the produce is of good quality supplies should be retained for Spring sowing. In a number of areas it will be necessary to purchase seed, as it is customary there to feed the oats in sheaf to live stock. Timely preparation should be made for obtaining the quantities required and where any doubt exists regarding the quality of the grain, samples should be submitted to the Department's Seed Testing Station.

Barley :—It is highly probable that imports of maize will be much restricted during the War. Crushed barley has proved an excellent substitute for maize or Indian meal when fed to live stock, especially to pigs. Where the soil is suitable, increased areas should be devoted to the growing of barley. There are varieties available which produce good yields on medium soils. These varieties should, where possible, be sown for feeding to farm stock.

Rye :—The cultivation of this crop is confined at present to very limited areas. It was, however, grown very extensively in this country for human consumption at one period and, in a number of European countries, this is still the practice. Farmers may consider it advisable to extend the area under this crop, especially where other cereals would not give satisfactory yields. The grain forms an excellent food for all kinds of farm animals.

Wheat :—Considerably increased areas will be devoted to this crop in the coming season. Autumn-sown varieties have given excellent results, but a number of farmers prefer to sow Spring varieties. It is probable, however, that the latter will be very scarce, and more attention should be given to varieties, such as Squarehead Master, which may be sown with safety in a normal season in the early Spring months. Where the soil is suitable the necessity for growing at least a small area of wheat need scarcely be emphasised. Should the produce be available for sale, a guaranteed price of 35/- per barrel for the highest grade has been fixed for this crop.

Field Beans :—Field beans were grown generally throughout the country some fifty years ago. Imported feeding stuffs, especially cakes, later came into general use and the area under this crop showed a corresponding decrease. Once again farmers may find themselves without imported supplies and they are strongly advised to grow this crop where the land is suitable. Bean meal is a valuable food and provides an excellent substitute for cakes and similar food stuffs.

Root and Green Crops :—Where local conditions permit, the area under root crops should be increased. Cabbage, rape, vetches, etc., would provide excellent feeding for live stock, especially at scarce seasons of the year, and an extension of the area under their cultivation is strongly recommended.

Other Crops :—Considerable areas have been devoted to the growth of onions and beet in certain parts of the Congested Areas. A guaranteed price of 60/- per ton factory weight has been fixed for sugar beet grown next season having a sugar content of 17.5 per cent., with a specified addition to or deduction from this price according to the sugar content.

During the past two or three seasons the growth of onions has been extended considerably and profitable returns have been obtained where the

necessary care and attention has been devoted to this crop. Following the procedure of recent years, it is proposed to reserve the home market for this crop during the period when supplies are available.

Manures :—Normal supplies of artificial manures, especially those containing potash, may not be available in the coming Spring. The greatest care should, therefore, be taken of farmyard manure, and seaweed should be used extensively in seaboard areas. Liquid manure is often wasted and, as it is particularly rich in potash, the need for conserving supplies is obvious. Peat mould or other suitable litter might be freely used in sheds and around the manure heap. Supplies of farmyard manure may be increased by the housing of live stock and the liberal use of litter.

Seaweed will be available in a number of areas during the coming months. It is a complete manure and contains a large amount of potash. Its use is strongly recommended at present. It can be spread on the land at this season and worked into the soil later in the year. Numerous experiments have clearly shown that seaweed is an excellent manure for all farm crops.

In order to avoid disappointment farmers are strongly advised to place orders early in the season through the usual trade channels for their requirements of artificial manures.

Reclamation and Lime Schemes :—These Schemes have been in operation in a number of counties during the past few years and the results have been highly satisfactory. Fresh land is essential for the production of satisfactory crops especially potatoes. Small grants are made available to eligible applicants to cover part cost of the reclamation, and lime is supplied at reduced rates. Farmers are strongly advised to make full use of these Schemes.

Live Stock :—Live stock and live-stock products are likely to be in considerable demand during the War period. Breeding stocks of all farm animals especially of pigs and poultry should, at least, be maintained, and increased where possible. Home-produced foods such as grain, potatoes, milk, etc., are quite as suitable for feeding pigs and poultry as the imported foods which are frequently used.

Implement Loan Scheme :—Under the Scheme administered by the Department of Agriculture loans are provided for the purchase of farm implements. Applications for loans should be submitted well in advance of the time when the implements are required.

General Advice :—Where farmers are in doubt regarding any of the foregoing or other matters, they should immediately get in touch with the local Agricultural Officer who will be pleased to give them further advice on farming matters generally.

Home Produced Foods For Poultry Feeding.
(issued in January, 1940).

In the event of a continuation of the world conditions arising out of the War, a considerable reduction in the quantities of live-stock foods imported into this country is anticipated. It is probable therefore that a partial or total replacement of the imported foods used heretofore for poultry feeding by foods produced in this country will be necessary. The following information regarding the use of home-produced foods for poultry feeding will, it is hoped, be of assistance to poultry keepers in the feeding and maintenance of their flocks under existing circumstances.

The rations fed to growing, laying and breeding poultry normally consist mainly of cereal grains or the by-products of these grains. These foods are the principal source of carbohydrates, substances necessary to provide heat and energy and to form fat in the bird's body and in the egg. The cereal portion of the ration of such poultry must be supplemented by a small proportion of protein food usually of animal origin, in order to supply the materials necessary for the formation, of tissue and muscle in growing birds and for the manufacture of the protein included in the egg in the case of laying stock. In addition certain minerals, used mainly for the purpose of bone or egg shell formation, and food factors known as vitamins, which are essential for normal growth and health, are necessary in the different rations. An adequate supply of clean fresh water is also necessary in the diet of the classes of poultry mentioned. The food of fattening poultry usually consists almost entirely of cereal grains or their by-products, with small additions of protein, preferably in the form of separated milk.

Imported maize in some form has heretofore constituted a considerable part of the cereal portion of poultry rations on many farms. Fortunately maize can be replaced partially or completely by either home-grown cereals or potatoes without impairing the efficiency of the poultry ration. The following notes indicate the value of the home-produced foods that are suitable for poultry feeding.

Barley and Barley Meal– This is a suitable food for all kinds of poultry if fed with discretion. The grain may form up to thirty per cent. of the grain feed of laying or breeding stock. Barley meal may replace maize meal in the mash of either growing, laying or breeding stock. Very fine grinding of the meal is essential, especially in the case of chickens and young stock. Barley meal is a very suitable constituent of the ration for fattening birds.

Oats and Ground Oats—The grain is most suitable for all kinds of laying stock and also for growing stock after about three months of age. As pinhead oatmeal or groats, the oat kernel is very useful as a grain feed for young

chickens. Finely ground oats can form a considerable proportion of the mashes of laying or growing stock and with separated milk makes the most satisfactory ration possible for fattening purposes.

Wheat and Wheat By-Products—The grain is excellent for all classes of poultry if available at a reasonable price. The by-products of the flour-milling industry, namely, bran and pollard, are excellent foods for all classes of poultry.

Potatoes—Cooked potatoes are a very useful carbohydrate food and are suitable for inclusion not only in the diet of fattening and laying stock but also in that of growing stock during the later stages of growth.

Potatoes should always be cooked before feeding and may be used to replace maize in poultry mashes. If necessary, cooked potatoes may be included in laying mashes in quantities up to half the weight of such mashes, but it is inadvisable to include such a high proportion if sufficient cereal meals are available. Experimental evidence indicates that rations containing potatoes give best results when fed in conjunction with separated milk. In all cases in which potatoes form part of the ration they should be cooked fresh or at least used before they become stale and difficult to blend into an appetising mash.

Roots, Vegetables and House Scraps—Mangels, turnips, cabbages and other vegetables make a useful addition to the diet of poultry, and house offals such as bread, cooked vegetables and meat scraps may with advantage be included in the wet mash fed to laying and breeding stock.

Separated milk or skim milk—This is the most useful of all protein foods, not only because of the high quality of the protein it contains but also because of its mineral and vitamin contents, which are of particular importance in the nutrition of young growing stock. Where ample separated milk is available no difficulty whatever arises in providing suitable proteins for poultry feeding. Separated milk may be fed to all kinds of poultry in the liquid state instead of drinking water and may also be used in preparing wet mashes.

On farms where separated milk is not available the proportion of protein concentrates such as meat meal, meat and bone meal, and fish meal, included in poultry rations will possibly have to be reduced to a lower level than heretofore. In this connection the attention of poultry keepers is directed to the value of free range in the nutrition of poultry. Ample range is a great asset in that it provides poultry with protein in the form of insects, and als

from young grass and clover throughout the greater part of the year. The fullest use should, therefore, be made of portable poultry houses on pasture and especially on stubble over which growing poultry should be allowed to range.

A certain amount of mineral material, mainly calcium, is required by laying fowls for the manufacture of egg shells. When such fowls have access to good pasture they can usually procure their mineral requirements. Under more intensive conditions of management it may be necessary to supply lime in some form to laying fowls. Crushed oyster shell is the usual source of supplementary calcium for laying fowls ; but ground limestone or limestone grit and crushed egg shells are equally suitable sources. Where growing stock have access to grass runs and are given separated milk or skim milk the addition of supplementary minerals to the ration is unnecessary. Even under the most intensive methods of brooding and rearing the mineral requirements of growing stock can be satisfied by the addition to the ration of small quantities of finely ground limestone and common salt.

Although a number of different vitamins are necessary for health and egg production in laying stock and for fertility in breeding stock, the quantities required are very small and the supply provided by such natural sources as green food, grain embryos and direct sunlight is usually adequate, so that in practice special provision for the supply of vitamins is unnecessary in the case of adult stock kept under natural conditions on free range. Even with chickens that are allowed on to fresh grass runs a couple of weeks after hatching a serious deficiency of these vitamins is unlikely to occur except possibly during very severe weather in the early part of the year. It is imperative, however, that the chickens should have access only to fresh, clean land which had not previously been stocked with adult birds, and best rearing results will be obtained if fresh brooding and rearing ground is used each year. Under conditions in which the rearing ground has become contaminated with parasites and where no alternative to raising the chickens in confinement exists, a supply of maize and cod liver oil should, if at all possible, be reserved for them. If the maize and cod liver oil available are insufficient to supply the amount of vitamins required, the chickens should be supplied with green food from uncontaminated land, and provision for the entrance of direct sunlight to the brooder house should be made.

The following rations suitable for the different classes of poultry are composed mainly of home-produced foods :—

Rations for Chickens.

1st week	Pinhead oatmeal alone or with small or cut wheat three times daily. Dry bran in a hopper may also be provided a couple of times daily for half-an-hour.

2 to 10 weeks	Mash	4 to 8 parts by weight pollard.
		2 to 3 „ „ „ finely ground barley,
		3 „ „ „ bran or finely ground oats.
		1 part „ „ meat and bone meal, meat meal or fish meal.
	Grain	Either pinhead oatmeal alone or with small wheat if available.

Mash may be fed dry or moist.

If separated milk or skim milk is given instead of drinking water and is also used in wetting the mash, the meat and bone meal, meat meal or fish meal in the mash may be reduced or omitted.

Two feeds of grain may be given daily and dry mash in waste-proof hoppers may be allowed during the greater part of the day. Cod liver oil at the rate of 1 pint per cwt. of mash should be added when chickens are raised in confinement and during severe weather in the early part of the year even where chickens have access to grass runs.

Fine limestone grit should be provided, especially if intensive rearing is practised, and 1 per cent. of common salt might be added to the mash if meat meal is the only protein food used.

Rations for Growing Stock (*pullets* 10 *weeks of age to laying*).

The mash may be similar to that suggested for chickens from two to ten weeks of age except that the meat and bone meal, meat meal or fish meal is reduced by one half and the bran or finely-ground oats increased by an equivalent amount.

Oats are the most suitable grain feed.

The mash may be fed dry except when cooked potatoes are included, when it should be fed in wet condition. Cooked potatoes may replace portion of the barley or pollard in the mash—four parts potatoes being equivalent to one part mixed meals. Except in special circumstances it is desirable to restrict the proportion of potatoes to one-third of the weight of the mash. When potatoes are fed in quantity it is advisable to increase slightly the proportion of meat and bone meal, meat meal or fish meal in the ration.

On the other hand, where separated milk or skim milk is given instead of drinking water and where it is also used for wetting the mash the purely protein foods—meat and bone meal, meat meal or fish meal—may be reduced or left out altogether.

Lime in some form should be available to growing pullets even on free range, and one per cent. common salt should be added to the mash if meat meal is the only protein food used.

The change from chicken ration to pullet ration should be brought about gradually during the period when the birds are from ten to fourteen weeks of age.

Rations for Laying and Breeding Stock.

The mash may be the same as for chickens from two to ten weeks of age.

Cooked potatoes may take the place of mixed meals in the mash to the same extent and under the same conditions as in the case of the mash for growing stock.

Similarly separated milk or skim milk may replace the meat and bone meal, meat meal or fish meal.

One per cent. common salt should be included in the mash if meat meal is the only protein food given.

Cod liver oil at the rate of one pint per cwt. of mash may be added to the mash of breeding stock.

The grain feed may consist of either—

(*a*) equal parts of wheat, oats, and barley, or

(*b*) two parts oats and one part barley, or

(*c*) oats alone.

Two ounces of grain per bird may be allowed daily.

Limestone grit, crushed egg shell or crushed oyster shell should always be available, particularly if the birds have not access to free range.

During winter raw mangels, turnips, cabbage or other green vegetables may be given in the house or runs. Fresh supplies should, however, be provided daily.

Fattening rations.

Either (*a*) Finely ground oats, mixed with separated milk or skim milk, or

(*b*) Equal parts finely-ground oats and finely-ground barley mixed with separated milk, or

(*c*) 1 part by weight finely ground oats
1 „ „ „ „ „ barley meal
1 „ „ „ pollard
1 „ „ „ cooked potatoes
} mixed with separated milk.

Hints on Poultry Management.

(issued in March, 1940.)

While it is inevitable that the poultry-keeping industry will be affected to some extent by the difficulty in the present emergency of procuring supplies of imported food stuffs and equipment it is fortunate that the great majority of poultry in this country are kept as a side line on general farms and, therefore, under conditions that make the maintenance of flocks, even in the present circumstances, a relatively easy matter.

In recent years a great increase in the use of imported foods for poultry feeding has taken place and many poultry keepers have come to regard maize meat and bone meal, meat or fish meal as indispensable in poultry rations. This is quite erroneous since home-grown cereals and potatoes provide suitable substitutes for maize, while separated milk or skim milk is the most suitable source of protein for all kinds of poultry. Accordingly poultry keepers who are in a position to grow sufficient oats, barley or wheat should not depend on outside sources for their supplies but should do everything possible to increase the area under home-grown cereals. Poultry-keepers who have to depend on purchased foods will find it increasingly difficult to continue in production and the organisation of their food supplies will have to be planned carefully. Although a substantial increase in the production of home-grown cereals is anticipated and while it is possible that the supply of imported foods will become more regular after a time, there is nevertheless an urgent need for re-organisation and better management of poultry flocks in order to conserve the food available and use it to the best advantage.

High Quality Laying Stock :—The principal factor in successful commercial poultry-keeping at any time, but especially during a period like the present, is the quality of the stock kept. Maximum profits can be obtained only from birds of the highest productive quality that are fed, housed and managed properly. The maintenance and feeding of mongrel birds of poor quality, particularly when food is scarce and high in price, cannot be justified and it would be far wiser to give up poultry-keeping altogether than continue to keep such birds. Poultry-keepers should at the present time endeavour to improve the quality of their poultry. Those who already keep pure-bred birds should procure additional stock only from the best sources, while owners of mongrel flocks should take immediate steps to replace such stock with reliable pure-bred birds. For this purpose the facilities provided by the Poultry Stations established by the Committees of Agriculture should be fully utilised. At such stations hatching eggs and day-old chickens of excellent quality are available at reasonable prices. The breeding stock of these stations is specially selected by the Poultry Instructors and every precaution is taken to ensure that the stock is healthy and free from disease. Hatching

eggs, day-old chickens and adult stock of high quality are also to be had from a number of poultry breeders throughout the country.

Culling :—Amongst even the best flock of pure-bred laying pullets there will always be individual birds that are bad layers and such unproductive birds should be rigorously discarded as they are a cause of considerable loss. Not only are the poultry flocks kept on many farms poor in quality but a large proportion of the birds are too old to give profitable egg production. Even pure-bred birds of good laying strain do not lay a sufficient number of eggs after their second year to enable them to be kept for commercial egg production at a profit. Hens over two years should therefore never be kept except for breeding purposes. The culling of the older birds that are not used for breeding and of the younger unproductive birds should be carried out regularly and a considerable saving in food will thereby be secured. Culling should not be confined to adult birds but should be a routine practice from hatching onward. Weakly and unthrifty chickens and growing stock should be discarded or disposed of when noticed, and when the pullet laying flock is selected in the autumn only the best developed and most promising birds should be retained. Such methodical culling would have a beneficial effect not only on the returns from poultry-keeping but also on the health of the poultry in the country. Instruction and demonstrations on culling and on the methods of identifying unproductive and unhealthy birds may be obtained from the Poultry Instructors.

Feeding :—The provision of suitable foods for poultry is the most immediate problem as supplies of the imported foods normally used for poultry feeding are irregular and restricted. To the great majority of poultry-keepers in this country the provision of suitable foods should present no difficulty as home-grown oats, barley, potatoes and wheat are excellent substitutes for imported maize, while skim milk or separated milk is even more suitable for all classes of poultry than any of the concentrated protein foods like fish meal, meat and bone meal and meat meal, considerable quantities of which are imported into this country.

The necessity for utilising all available food to the best advantage and avoiding the wastage of food involved in maintaining old, unhealthy and unproductive stock has been mentioned. The more general use of wet mash feeding is recommended at present as it is less wasteful than dry mash feeding and moreover it facilitates the utilisation of cooked potatoes and kitchen offals. Considerable waste of food often occurs where careless feeding methods are practised. Under the conditions obtaining on many farms where suitable hoppers are not provided there is invariably loss of food, especially with chickens, owing to scattering of dry mash on the floors of poultry houses or on poultry runs. Feeding in the open by throwing grain or mash on the ground outside the poultry house is not only wasteful but also likely to spread disease, and the scattering of grain in the litter in poultry

houses especially where the houses are not kept perfectly clean is objectionable for the same reasons.

Management :—The management of young and adult poultry is of the utmost importance particularly at the present time. In recent years indoor or intensive methods of brooding chickens have supplanted older methods of brooding on most farms and even intensive methods of keeping laying birds have been adopted in some places. These methods which may be feasible in normal times cannot be recommended in the present circumstances as it may not be possible to provide the complete rations required by birds kept under such conditions. The value of clean range for the development and health of growing stock and for the maintenance of health in adult poultry has long been recognised and outdoor methods of brooding, rearing and management should therefore be employed to the greatest possible extent. The provision of ample range for poultry should be no problem whatever to the majority of poultry-keepers in this country, yet on many farms although ample land is available the poultry are constantly confined to small areas and thereby subjected to all the disadvantages of highly intensive poultry-keeping. Chickens should be allowed on to grass runs a couple of weeks after hatching. It is essential however that they should have access only to fresh ground and on no account should chickens be allowed on to ground on which adult poultry are kept. The brooding and rearing ground should be entirely apart and no poultry other than chickens should ever have access to it. Best results will be obtained if fresh brooding and rearing ground is used each year. The importance of providing separate land for growing and adult stock cannot be over-emphasised, as it is a fundamental necessity for the raising of healthy young stock. The separation of young and adult stock may appear difficult on many farms but with proper organisation it is by no means impossible. Adult poultry of all kinds should also be allowed to range as much as possible, not only because birds on free range are healthier but also because a good range provides much supplementary food in the form of insects, seeds and even young grass and clover. The fullest use should be made of stubble after the corn has been removed in autumn and where danger from foxes does not exist both growing and adult stock might be run on the stubble. Portable houses could be usefully employed at this time of the year. The removal of the birds from their usual quarters provides the opportunity for resting, treating or even cultivating ground on which poultry have been kept for a number of years.

Housing :—In periods of world crisis the cost of building or erecting poultry houses is usually very high and consequently it is questionable if expenditure should be incurred on the erection of permanent or semi-permanent houses at the present time. The use of portable, slatted-floor houses on free range is much more economical, as these houses provide greater accommodation per unit of floor area than any other type of house. Moreover they can be used for different classes of birds. On many farms existing

buildings can at little cost be converted into suitable and satisfactory poultry houses. When such houses are used arrangements should be made so that the birds have access to a grass field and not to the farm yard. Whatever kind of houses are used they should provide ample floor and perch space, sufficient light and ventilation and they should at all times be kept in a clean and sanitary condition.

Food Production in the Garden: Seasonal Operations.

(issued in July, 1940).

The value of vegetables as human food is generally recognised and it is regrettable that at certain periods of the year even ordinary vegetables are sometimes so scarce and dear as to make their general use impracticable. It is, therefore, of the greatest importance that cottage gardens and all other available land should be utilised to the greatest possible extent so as to ensure a supply of vegetables throughout the year.

Considerable areas of gardens are frequently allowed to lie idle during the winter and early spring months instead of carrying useful crops. Owners of gardens are advised to take immediate steps to plant certain vegetables for winter use and to sow seeds of others for spring supplies.

Plants of Cabbage, Kale, Savoy, Cauliflower, Broccoli, Lettuce, Leeks and Celery are still procurable and it is not yet too late to plant them out in well prepared sites. Ground from which a crop of early potatoes has been dug is ideal and is usually rich enough to encourage rapid growth. As the success of these crops depends mainly upon a quick start in growth, it is essential that no delay should occur in getting the vacant ground planted.

The sowing of vegetable seeds is equally important at this time of the year.

To produce Cabbage for cutting next April and May, seed of Offenham or Flower of Spring should be sown in a fine seed bed as soon as possible. Another portion of the seed bed should be sown in mid-August with Onion seed of the varieties Reliance and Solidity to produce large bulbs next year. White Lisbon sown at the same time will produce Onions for use as scallions next spring.

If Cauliflower seed is sown in mid-August and the plants protected by a frame or other means until planting time in April, useful heads will be produced next June.

A crop of Lettuce may still be obtained before October if seeds are sown immediately. Seeds of the White Passion and Imperial varieties should be

sown about the middle of August and transplanted during October into suitable quarters for wintering. These varieties are quite hardy and will produce excellent heads for spring use.

For more detailed information consult the Instructors in Horticulture and read Leaflet No. 36 (The Vegetable Garden) copies of which may be obtained, free of charge, from the Department of Agriculture, Dublin.

FEEDING STOCK ON HOME PRODUCED FOODSTUFFS.

BY

E. J. SHEEHY, D.Sc., F.R.C.Sc.I.

Even in peace time dependence on imported feeding stuffs leaves the stockfeeder at the mercy of every economic factor which controls their supply and cost, but when war interferes with sea-borne commerce, rendering importation more costly and supplies curtailed and irregular, the increased production at home of stock foodstuffs becomes imperative.

The item of feeding which is available in greatest abundance in this country is pasturage, and it is a matter of primary importance that it should be used to the best advantage. Generally speaking, grass does not become abundant until mid-summer when there is indeed an excess. In late summer and autumn the permanent pasture has begun to fail and in winter the amount of feeding which it provides is very small indeed. A supply of pasturage in the spring and early summer, when as a rule grass is scanty, is of appreciable benefit to cattle and sheep and it is possible to advance growth by some three weeks by the application of farmyard manure in winter or of nitrogenous fertiliser in early spring. Similarly an extension of the effective pasturage period later into the grazing season can be produced by winter manuring with dung or a phosphate fertiliser. Generally speaking, manuring effects a very considerable increase in pasture productivity throughout the season, renders the grass more palatable and raises its nutritive value. The necessity for destroying pasture weeds may appear too obvious to mention, yet quite an appreciable portion of the land which would otherwise be producing the best of stock food, is, year by year, taken up with thistles, ragwort and such useless plants. The topping of the grass flowering heads in July, apart from its effect in suppressing weeds, does much to thicken the sole of pasture and to increase its stock-carrying capacity. Grazing the different fields in rotation also increases productivity and helps to maintain the nutritive content of the pasture at a high level throughout the entire season. Many of our pastures are unproductive because of poverty and unsuitable flora, and the ploughing, manuring and re-seeding of these would correspondingly increase the effective pasture acreage. At a time when the greater production of home-grown foodstuffs is so very desirable more can be done for the better feeding of cattle and sheep by better grassland husbandry than by any other single activity.

No matter how well managed, however, pastures yield little before April or, in some parts of the country, May; and even when the aftergrass is taken into account pasture needs to be supplemented with other foodstuffs from September onwards if stock is to be kept thriving and productive. For cattle and sheep and also to a lesser extent for pigs, an excellent supplementary feed for the period from the first of October to the beginning of the new year is obtainable from forage crops. Rape is an exceedingly useful food for fattening sheep over the winter season. Cabbage in October maintains the milk yield of cows and promotes growth and thriftiness in calves and young stock. Kale in November and December serves a similar purpose for cattle and, if needs be, may be usefully employed for sheep feeding also. These and other kinds of forage crops supplement pastures and, if available in abundance, may supersede concentrated foods or other fodder or roots for the feeding of cattle or sheep before the new year. Thus the supplies for the winter feeding period proper may be conserved by growing forage crops for feeding in late autumn and early winter. At that time there is still some grass but if stock obtain no other feeding they decline, milk yield drops and the animals enter the more severe winter period in a weak and, of course, unproductive condition.

The commencement of the winter feeding period proper is thus postponed by the use of some of those farm-produced forage crops which grow so freely and liberally in this country. Indeed, in the more sheltered parts kale, which withstands winter conditions well, may be available into the new year. After the winter period proper, to which special reference will be made later, a season is reached when the growth of pasture is awaited and when the haggards and barns are rapidly emptying. For the feeding of cattle and sheep and, to a lesser extent pigs, at this time, *i.e.* in late March, April and early May, according to location, farm-grown forage crops may again be made available. The following are suitable for cutting and feeding in the house, yard, or on bare pasture—hardy greens, rye, vetch, and oat mixture, rye grass. Rape too, may be grown tall enough for cutting but if grazed in autumn it is more suitable for grazing again in spring. Spring forage crops afford a very nutritive and succulent supplement to the rather bare spring pasture and to the dry fodder or concentrated foods which by this time have become almost exhausted. Frequently grass is rendered late by unfavourable spring weather in which case the forage crop proves of very special benefit and, even though there is a favourable spring for grass and the forage is not so much needed, nevertheless the feeding of the forage spares the grass for conversion into silage for subsequent winter feeding. If forage crops are abundant they may form the sole food of cows, young and store cattle and sheep at this time of year. When reliance is placed on forage crops for feeding over a considerable part of the spring it is advisable to grow a variety of them and to have them sown in breaks so that different successively-sown strips will mature in rotation.

Emphasis has been laid on grass including, of course, clover, and green forage crops because by the better utilisation of pasture and by the greater production of cabbage, kale, rape, vetches, rye grass, etc., farmers can go a long way towards avoiding difficulties due to the curtailment of imported foodstuffs. To supplement the forage crops in the pre- and post-winter periods and to supply the major portion of the dietary, for cattle at any rate, in winter the stock feeder can have abundance of good hay, well-made silage, straw, roots, and potatoes.

The quality of hay is a matter of importance. Hay cut in the early flowering stage and made up with the minimum of exposure to weathering influences is half as good as barley. On the other hand if cutting is postponed till the seeding stage is reached and if there is undue delay in the making, thus subjecting the material to excessive weathering, the hay has a value of only one-quarter that of barley. It is true that the depreciation and degree of loss in curing is affected by the weather conditions, but the management factor is also important as the following figures, which represent results obtained in this country, show :—

Losses in Haymaking from date of cutting to time of consumption.

	With good management	With indifferent management
In good hay-making weather ..	25%	33%
In very bad hay-making weather	33%	58%

Hay should not alone be well made but carefully fed. The necessity for preventing waste in the haggard is perhaps too obvious to mention, and since it is wise to reserve the greater portion of the hay till the latter part of the winter it should, in view of the long storage period, be very carefully conserved. It is a great mistake to feed hay in excessive quantity. This is wasteful of food and may do more harm than good to the animal. Hay should be rationed according to requirements so as to make the most of this valuable foodstuff.

Properly-made silage, whether from grass or clover or from other crops specially grown for the purpose, is an excellent foodstuff. It contains all the nutritive value of the green material from which it is made. It is palatable, succulent, and rich in protein, minerals and vitamins, as well as the other more familiar food ingredients. As a food for milch cows, fattening and store cattle, calves and, to a lesser extent, sheep it is very strongly recommended and, because of its composition, it is a great help in a time of emergency to "balance" the ration for these animals.

Good straw has for cattle a feeding value equal to one-quarter that of barley so that at the present price of the latter the straw is a valuable food-

stuff. For store cattle from the age of one year upwards, for fattening stock and for dry and very low yielding cows it should be used as an alternative to hay. The coarser straw should, if necessary, be reserved for bedding so that at no time may good fodder, especially good hay, be sacrificed for this purpose. Again, when fodder is scarce the collection of furze, rushes, ferns, sand, etc., for use as litter helps considerably in the feeding problem by saving the fodder. Though straw from all cereals may be fed the oat straw is of superior quality, and the cutting of the oat crop slightly on the immature side improves the feeding value of the straw.

Roots are a well-known winter feed and, while their use has been decried in recent years, they are an abundant source of nutriment even though they are by no means " balanced." Carrots can be used to form quite a considerable part of the dietary of the horse, for which purpose they are of special value in the maintenance of health and of skin condition. Mangels are best reserved till after the new year as they improve in food value while maturing in the pit. Both turnips and mangels in season may, if other foods are scarce, be very liberally fed to cattle, but moderate amounts in a mixed dietary give correspondingly better results. Both may be fed to sheep but the turnip is preferable. As regards pigs, dry sows may be fairly liberally fed on mangels or turnips and, in the event of scarcity of other foods, the boiling of turnips for young and fattening pigs is justifiable. Young pigs can utilise only such a small proportion of roots in the raw condition that the use of raw roots is scarcely worth while.

Uncooked potatoes may be utilised to replace roots in stock feeding and a useful guiding principle is to feed half the quantity of potatoes that one would of roots. In large amounts they are rather laxative, and even in moderate quantity they should be introduced gradually into the dietary. For dry sows they may also be used raw in considerable proportions. When cooked the potato may form quite a large part of the ration of pigs and poultry. Up to one-half of the meal allowance in an all-meal ration may be replaced by boiled potatoes without any serious reduction of productivity and, in the case of pigs, even a larger proportion of potatoes may be used. It should be remembered that it takes 4 parts of potatoes to provide the same amount of nutriment as 1 part of meal so that if 4 pounds of meals were to constitute the allowance of a pig on an all-meal dietary and if potatoes were used to replace half the meals the dietary would then consist of 2 pounds of meal and 8 pounds of potatoes.

The other home-produced classes of feeding which are available are:—grain, especially oats and barley and to a lesser extent wheat, and (in restricted areas) rye; separated milk; fish meal (very limited quantity); meat meal (limited quantity); brewers and distillers grains; malt combings (limited quantity); sugar pulp; bran; pollard. Mention should also be made of stillage or potato alcohol wash which in the neighbourhood of

the alcohol factories is available during the manufacturing season. A very limited quantity of home-produced oil cakes, namely linseed, palm nut, coconut and earth nut, is available but the production of these, with the exception of linseed cake, depends on the importation of the raw materials from which they are made.

Luckily the maize which is so freely obtainable in peace times can be replaced in the feeding of all sorts of stock by home-grown corn. For the feeding of cattle and sheep, oats and a proportion of barley can be substituted for maize, while in pig feeding the place of maize may be taken by barley and a proportion of oats. It is true that in the colouring of yellow maize there is a food factor namely vitamin A, which is absent from all home-grown cereals, but fortunately grass, green forage crops and all sorts of green food, carrots, green silage and, to a lesser extent, good hay and turnips contain this factor and are obtainable on the farm in abundance. The shortage of oil cakes in war-time constitutes a different problem because these have been used to " balance " in a concentrated mixture the home-produced cereals in the food factor known as proteins or albuminoids. Wheat, barley, oats, rye, pollard and bran, as well as such foods as roots, potatoes and sugar pulp are all comparatively low in protein, and while they make a reasonably good ration in themselves, they do not yield the best results when used alone. Separated milk, dried grains, malt combings, and meat (and fish) meal are rich in this protein factor but there is not enough of these foods to replace the imported oil cakes. Fortunately the soil and climate of this country, in most parts, are very well suited to the production of a high protein food, namely beans, which " balances " the meal ration and is suitable for all stock. Farmers should, therefore, include in their extra tillage an area of field beans. With a couple of hundred thousand acres of beans, and an extra half-a-million acres of corn for feeding stock, together with the increased supplies of the other feeding stuffs already mentioned, livestock productivity could not alone be maintained but be very considerably extended. The limited output of meat and fish meal, both of which are very rich in essential minerals, also creates a difficulty in the supply of sufficient minerals, especially to pigs and poultry. It so happens that good pasture, green silage and all green forage crops are very rich in both protein and minerals, and by fully utilising pasture and forage crops not alone for cattle and sheep but also for pigs and poultry, *i.e.* by providing green food for the greater part of the year, the problem of protein and mineral shortage on the farm is reduced to very small dimensions indeed.

It should be always borne in mind that the problem of farm feeding is a dual one, namely (1) the provision of abundance of food and (2) the giving of a dietary which contains all the ingredients necessary for the maintenance of health and for the promotion of good growth and production.

The feeding of sheep considered from this dual aspect presents no difficulty

whatsoever provided there is abundance of grass, including some young or renovated pasture, autumn and spring forage crops, together with good hay and roots and silage. Where trough feeding is neceessary any of the following is quite suitable, namely :—oats alone ; or a mixture of oats and sugar pulp ; or oats, sugar pulp and dried grains ; or any of these together with a small quantity of cake, if available. The important point is to ensure the provision of good nutritive green material including young grass or forage crops for ewes and lambs, and rape or other similar food for autumn and winter fattening.

Similarly in cattle feeding the supply in abundance of the various farm-produced foodstuffs is far more important than undue concentration on the formula for the meal mixture. Better grassland husbandry, more forage crops for autumn and spring, better hay, more silage and roots render the problem of cattle feeding an easy one. Calves must have meals, but when milk is available together with good hay or pasture, as the case may be, the " balancing " of the meal mixture in itself is not a matter of concern. In these circumstances crushed oats alone is quite suitable and when fed dry is more suitable for the production of healthy calves than many of the badly-prepared gruels used for calf-feeding. Suitable meal mixtures for calves are oats and barley meal ; oats and maize meal (or maize flake) ; oats and flaked wheat ; oats and any of the other foods mentioned together with a little linseed cake (if available) ; and oats and beans mixed in equal proportions. Fingered or sliced roots are a valuable addition to the dietary of the calf in winter. Grated raw potatoes in small quantity are similarly useful. In the absence of roots a mixture consisting of 3 parts of oats, and one part of sugar pulp, both fed dry, maintains the bowels in healthy activity. If separated milk does not form part of the calf's dietary the inclusion of 10 per cent. of meat meal in the meal mixture " balances " the ration in respect of protein and minerals. Should meals not be available in sufficient quantity boiled potatoes with possibly a little boiled turnips may be mixed with what meals are available. Uncooked cereals should not be fed in a sloppy form to the calf, *i.e.* they should not be merely mixed in a slop with either water or milk. Cereals should either be fed dry and uncooked or should be cooked into a mash. In all cases it is very important to add a pinch of salt to the calf food while feeding with meals continues. The money expended in rearing calves is largely wasted if, because of insufficient care, their progress is checked when they are about six months old. Some meal or mash feeding in addition to pasture, good hay, and roots should be continued till such time as the young stock can continue to make good progress on the coarser foods alone.

The house feeding of dairy cows in winter should depend on the quantity of milk which the animals produce. Dry animals do quite well on straw and a little roots or silage together with what grass there is on the pastures. Cows giving a considerable amount of milk must have some meals,

though low-yielding animals may be confined to a mixture of hay and roots or to silage alone which is an excellent food for dairy cows.

The following are a few specimen rations.

For a cow giving 1 gallon of milk daily :—

No. 1.	(a)	Hay	1 stone
	(b)	Straw	½ ,,
	(c)	One of the following :—	
		Roots	4 ,,
		Cabbage or kale or other forage crops	4 ,,
		Potatoes	2 ,,
No. 2.	(a)	Silage	4 stone
	(b)	Hay	½ ,,

For a cow yielding 2 gallons of milk daily :—

No. 1.	(a)	Hay	1½ stones
	(b)	One of the following :—	
		Roots	5 ,,
		Forage Crops	5 ,,
		Potatoes	2½ ,,
No. 2.	(a)	Silage	4 ,,
	(b)	Hay	1 ,,
No. 3.	(a)	Hay	½ ,,
	(b)	Roots	4 ,,
		or Potatoes	2 ,,
	(c)	Silage	3 ,,

Cows giving over two gallons daily should have extra feeding proportionate in amount to the extra milk yielded, and the following are examples of suitable meal rations which should be given in addition to any of the immediately preceding rations at the rate of 3½ lb. for each gallon of milk in excess of 2 gallons which the cows produce :—

No. 1.	(a)	One of the following :—	
		Oats	4 or 5 parts.
		Oats and barley mixture ..	,, ,,
		Oats and bran mixture	,, ,,
		Oats and flaked wheat mixture ..	,, ,,
		Oats and sugar pulp mixture ..	,, ,,
	(b)	Oil cake and/or a mixture of oil cake and meat meal as obtainable	1 part.

No. 2.	(a)	Oats	1 part.
	(b)	Dried grains	1 ,,
No. 3.	(a)	Oats	1 ,,
	(b)	Malt combings	1 ,,
No. 4.	(a)	Oats	2 or 3 parts
	(b)	Beans	1 part

Thus a cow yielding 3 gallons daily would receive the allowance outlined for a 2 gallon cow together with 3½ pounds of one of the meal mixtures; a 4 gallon cow would get the 2 gallon cow allowance together with 7 pounds of one of the meal mixtures.

It is always advisable to add a pinch of salt to whatever meal mixture is fed or, if it is mixed in with a quantity of the meal, to add 1 lb. of salt to each hundred-weight of the mixture. The above meals are in themselves somewhat deficient in protein, but if the hay is of good quality and some forage crops are available for autumn and spring, and good silage is obtainable for winter feeding there will be a considerable amount of protein forthcoming from these sources and the entire dietary will contain sufficient of this necessary food factor.

The feeding of fattening cattle in the house or stall with home-grown foodstuffs presents no difficulty. Straw, hay, roots (or potatoes) and silage should form the major portion of the dietary: the addition of a little green forage promotes health, improves the appetite and helps to " balance " up the ration but this is not necessary when a sufficiency of good silage is available.

In addition the following are suitable meals:—

No. 1. (a) Oats.

(b) One of the following:—

Barley.
Sugar pulp.
Barley and pulp.
Barley and pollard.

No. 2. Mixture 1 supplemented by oil cake (as available) to form one-eighth of the ration.

No. 3. (a) Oats.

(b) Beans.

No. 4. Oats alone.

Salt should always be added to the meal allowance in the proportion of 1 lb. of salt to each hundredweight of meal.

The dietary of the pig must be considered with much care so as to avoid ill-health and unthriftiness due to a deficiency of any food factor. Where there is a reasonable supply of separated milk and even a limited supply of green feeding there is no danger of such a deficiency and any suitable mixture of cereals or other home-produced foodstuffs with the milk and green feeding makes up a complete ration. As already mentioned yellow maize, which has been so freely used in this country for pig feeding, contains a food factor namely, vitamin A, which is practically absent from all home-produced pig foods with the exception of green fodder, namely grass, clover, cabbage, rape, kale, vetches, etc. This vitamin A factor which provides for growth and thriftiness is as important in pig-feeding as the light factor which prevents cramp and rickets. Hence the emphasis on a supply of green feeding, whether as a pasture or otherwise, for pigs as well as for other stock. A continuous supply of green food for the greater part of the year for the purpose of supplementing meals is almost a necessity when pigs are confined entirely to home-produced feeding stuffs. Not alone does it supply the essential vitamins and minerals but also very valuable protein materials.

In the summer season dry sows can obtain almost sufficient food from pasture or green forage crops and in the winter season from raw potatoes, raw turnips and mangels supplemented by a run on pasture or by other green feeding. On the approach of farrowing it is necessary to get the sow into forward condition and some meals are necessary. Any of the meal mixtures detailed below for pig-feeding purposes may be used for the sow as a supplement to the coarser foodstuffs already mentioned. The suckling sow should be liberally fed. For her the dietary suitable for a dry sow should be supplemented by a meal mixture, any of those detailed for young pigs being suitable.

In the trough-feeding of bonhams it is necessary to exercise special care in the choice of foods as their digestive system is very readily disorganised. Some bran and pollard should be reserved for them, and a little boiled potatoes may be added. Oats, sugar pulp and even barley in high proportion are not suitable for young bonhams. A little green feeding, *i.e.*, pasture, cabbage, kale, rye grass, rape, etc., is of particular value to prevent unthriftiness and to enable weaklings to keep pace with the stronger litter mates. The weaning is a critical stage and, in the absence of a liberal supply of yellow maize, some green feeding is essential. Even with maize the green food is highly beneficial especially in preventing members of the litter falling seriously behind the others and becoming unthrifty. In addition to a green food supplement the following are suitable mixtures for young pigs :—

No. 1. (*a*) Bran.
(*b*) Pollard.
(*c*) Boiled potatoes.
(*d*) Separated milk.

No. 2. (*a*) Bran.
(*b*) Oats, 15 per cent. of ration.
(*c*) Barley.
(*d*) Kitchen refuse.
(*e*) Separated milk or meat meal 10 per cent. of ration.

No. 3. (*a*) Wheat.
(*b*) Boiled potatoes (or boiled turnips).
(*c*) Beans, 20 per cent. of ration.
(*d*) Ground limestone or sterilised bone flour 1 per cent. of ration.
(*e*) Common salt 1 per cent. of ration.

Older pigs benefit similarly by an allowance of green feeding, given daily or at least 3 or 4 times per week. From the age of 14 weeks onwards any of the following meal mixtures is suitable.

No. 1. (*a*) Barley or pollard or a mixture of both.
(*b*) Oats 30 per cent. of the ration.
(*c*) Kitchen refuse.
(*d*) Separated milk or meat meal 6 per cent. of ration.

No. 2. (*a*) Pollard.
(*b*) Sugar pulp 15 per cent. of the ration.
(*c*) Potatoes —(see earlier reference on page 244) or boiled turnips.

No. 3. (*a*) Wheat, Oats, Barley, Sugar pulp, Beans — equal parts.

(*b*) Sterilised bone flour or ground limestone 1 per cent. of ration.

(*c*) Common salt 1 per cent. of ration.

Whatever foodstuffs are available for trough feeding to pigs, calves, dairy cows or other stock some organisation is necessary so as to facilitate the work of feeding, to prevent grievous errors in the rationing, to avoid waste,

and to make animal feeding an interesting task rather than monotonous drudgery. Space to prepare the mixtures and suitable storage are essential. A loft or a concrete floor in the food house may be temporarily cleared for the mixing process and the only other equipment needed are compartments close at hand in which the respective mixtures may be stored for use. Metal bins make suitable storage but they are expensive. Wooden ones may be used instead, or alternatively a few partitions may be run out from a wall with a convenient space between them, thus making a number of compartments which are most convenient both for filling and from which to remove the daily feeds as required. A card hung up in each compartment naming the purpose for which the feed is to be used and giving the formula of the mixture completes the necessary organisation. A little thought and time spent in arranging such facilities make for more progress than much slavish and unmethodical physical work.

(Received for publication on 12th January, 1940.)

MARKETING OF IRISH APPLES

Of all fruits grown in this country none is more suited to the climate and soil than the apple. It is not surprising, therefore, to find that about half the area under fruit is devoted to apple growing and that apples constitute the most important item in our total fruit output. The area under apples has increased materially since the beginning of the century ; this increase is due mainly to the encouragement and assistance provided under the Educational and Production Schemes of County Committees of Agriculture. The main demand for apples in this country is for eating and cooking purposes but there is also a fairly substantial market for apples suitable for canning and for the manufacture of cider and jam.

While the production of apples has been increasing, the system of marketing has not been all that could be desired. Some growers have for a number of years efficiently graded their apples and marketed them in suitable boxes, but for the most part marketing has not been satisfactory. The necessity for grading and sizing has been ignored by many growers and the container which has been mostly used, namely the 9-st. barrel, has proved unsuitable for the proper display and marketing of high-grade fruit. Other undesirable features were a tendency to market certain varieties of apple before their proper season and a serious lack of co-ordination of marketing activities on the part of the suppliers. All these factors operated to keep the price of Irish apples generally at a rather low level.

To remedy the unsatisfactory state of affairs described in the preceding paragraphs the Department of Agriculture has prepared a scheme under which it is hoped that the bulk of the Irish apple crop will be marketed in 1940 and subsequent years. The scheme is a simple one and can be described very briefly. The Minister for Agriculture is taking steps to register a Mark for home-grown apples and other horticultural produce under the Industrial and Commercial Property (Protection) Act, 1927. The purpose of the Mark will be to indicate that the produce to which it is applied conforms to official requirements in regard to grading, packing, and other matters. Persons or bodies engaged in the growing or marketing of apples who undertake in writing to observe conditions laid down by the Minister for Agriculture may be granted licences to use the Mark in connection with apples marketed by them. Printed labels incorporating the Mark will be distributed by the Department of Agriculture to licensees, who will not be allowed to use the Mark apart from such labels. Each licensee must undertake to market not less than 10 cwt. of apples of the current crop, and must pay a fee calculated at the rate of 1d. for each label supplied.

As has been indicated above, licensees under the Apple Marketing Scheme will be required to grade and pack their fruit in accordance with the directions of the Minister for Agriculture. Three grades—Extra Select, Select and First Grade—are specified for dessert apples, and two grades—Select and First Grade—for culinary varieties. The diameter of Extra Select desserts must not be less than $2\frac{1}{4}''$ and each apple must be free from blemish, injury or disease, and be typical of the variety; the shape must be normal and the skin unbroken. Similar provisions apply to desserts of the Select Grade, except that surface blemishes due to scab spot or other cause are permitted up to a maximum total area of $\frac{1}{2}''$ square on any one apple. First Grade desserts must have a minimum diameter of $2''$ and surface blemishes on any one apple must not exceed $\frac{3}{4}''$ square in all. Select Grade culinaries must have a diameter of not less than $2\frac{3}{4}''$ and must be free from blemish, injury or disease. First Grade culinaries must be not less than $2\frac{1}{2}''$ in diameter and surface blemishes should not exceed in the aggregate an area of $\frac{3}{4}''$ square.

Apples marketed under the scheme must be packed in Bushel Boxes (desserts and culinaries), Half-Bushel Boxes (desserts) or 5-stone Boxes (culinaries). The boxes must be lined with paper or corrugated cardboard and sheets of the latter material placed above and below the fruit. Each apple packed in a Bushel or Half-Bushel Box must be wrapped in tissue paper of a suitable size. Packed boxes will be inspected by the local Instructor in Horticulture or other authorised officer, who will signify his approval of each box by signing and dating the relevant official label in the space provided. The label also shows the variety and grade of the fruit, whether the apples are dessert or culinary, the number of apples in the box (except in the case of the 5-Stone Box, when the weight of the apples will be shown instead) the date of packing and the name of the licensee concerned.

It is hoped that many growers who were, perhaps, reluctant in the past to apply strict standards of grading and packing on their own initiative will, now that official standards have been fixed and protected from abuse by a Government Mark, realise the advantages to be derived from orderly and efficient marketing and will adopt the scheme formulated by the Department of Agriculture. There is no doubt that the consuming public and the trade will also welcome a scheme which will make available to them fruit of good and uniform quality in much greater quantity than heretofore.

SALMON OF THE RIVER SHANNON.

By

ARTHUR E. J. WENT, Inspector of Fisheries.

I. ANALYSIS OF THE STOCK OF 1928.

INTRODUCTION.

The River Shannon, before the initiation of the Hydro-Electric Scheme, had a world-wide reputation as a salmon river. The construction of the great dam at Parteen in 1928-1929 completely altered the conditions under which salmon could reach the spawning grounds and it was, therefore, thought advisable that a knowledge of the life history, age and growth of the fish both before and after this change should be obtained. A paper by the late Rowland Southern, 1928, (5) dealt with the material collected in the years 1924, 1925 and 1926. The present author examined the material for 1927 and this paper represents simply a further stage in this series of investigations. Although over ten years had elapsed since the collection of the material, it was considered sufficiently important to carry on the investigation for those years in which the stocks of salmon were not affected by the Hydro-Electric Scheme. More recently, however, examination of samples of smolts has been carried out with the intention of determining the rate of freshwater growth and the age of the smolts under the new conditions prevailing in the River Shannon and the results of the examination of smolts for the year 1938 forms Part II of this paper. No material was obtained from adult fish after the year 1935 as salmon fishing in the Shannon estuary and in the river itself was only carried on by a few people. With the gradual revival of the River Shannon as a salmon river it is hoped to recommence in the near future the collection of material from adult salmon.

NOMENCLATURE.

The nomenclature used by workers on salmon in recent years has been adopted throughout this paper. The life of the salmon is normally divided into three periods. Firstly, there is its life in fresh water as a parr, from the time when it is hatched until it assumes the smolt livery and descends to the sea; secondly, there is its life in the sea before it returns to the river to spawn; thirdly, there is the period which it spends again in fresh water from the time it re-enters the river until it dies after spawning or returns to the sea as a kelt. We know nothing of the details of the second period except what can be determined by scale reading.

Salmon are classified primarily by age groups, that is on the duration of the second period spent feeding in the sea. Those fish which cease to feed in the sea during the winter months and return to fresh water early in the year, or in some cases during the winter months, with reproductive organs only slightly developed, are called " spring fish," *i.e.*, " small spring fish," " large spring fish " or " very large spring fish " according as they have spent two, three, or four winters feeding in the sea. Those fish which have resumed feeding in the spring of the year in which they re-enter fresh water and which will spawn in the following winter are called " summer fish." They are known as " grilse " or " peal," " small summer fish " or " large summer fish " according as they have spent a little more than one, two or three years respectively feeding in the sea.

The term " class " is reserved for the various age categories of smolts, one year smolt class, two year smolt class, etc.

MATERIAL.

The material used in this investigation consists of 1,140 sets of scales and data taken in 1928 at the Lax Weir Fishery, at the head of the tideway, about one mile above Limerick and from the rod catches in the stretch of the river from O'Brien's Bridge to Killaloe. I am deeply indebted to Mr. Liam Forde, Fisheries Director of the Electricity Supply Board, formerly Manager of the Lax Weir Fishing Co., and Mr. P. Whipp, late of Fort Henry, Killaloe, for providing this material. Examination of the confidential returns of the Lax Weir Fishing Company reveal that the proportion of fish sampled varied throughout the season and for this reason the tables giving the composition of the fish captured show the weighted figures which give a more correct idea of the conditions found in the stocks of 1928.

METHODS.

All fish examined were measured from the tip of the snout to the fork of the tail, and the length recorded to the nearest tenth of an inch.

SMOLT AGES.

The distribution of the smolt ages in each age group is given in Table I Appendix. One and two year smolts formed 97.4 per cent. of the whole, the remaining 2.6 per cent. consisted of three year old smolts. The percentage of one year smolts, 18.5, was not so high as that in 1927 but still was second in importance. Three year old smolts had increased slightly over the number for 1927 but were still comparatively unimportant. The percentage of one year smolts rises with increase in age in the spring fish. In the samples from 1928 the spring fish do not show, in general, a greater proportion of one year smolts than the summer fish of the same year class.

The monthly changes in the percentage of one year old smolts is given in Table 2 Appendix. In 1927 it was shown that the percentage of older smolts decreased as the season progressed but in the 1928 samples this phenomenon was not observed.

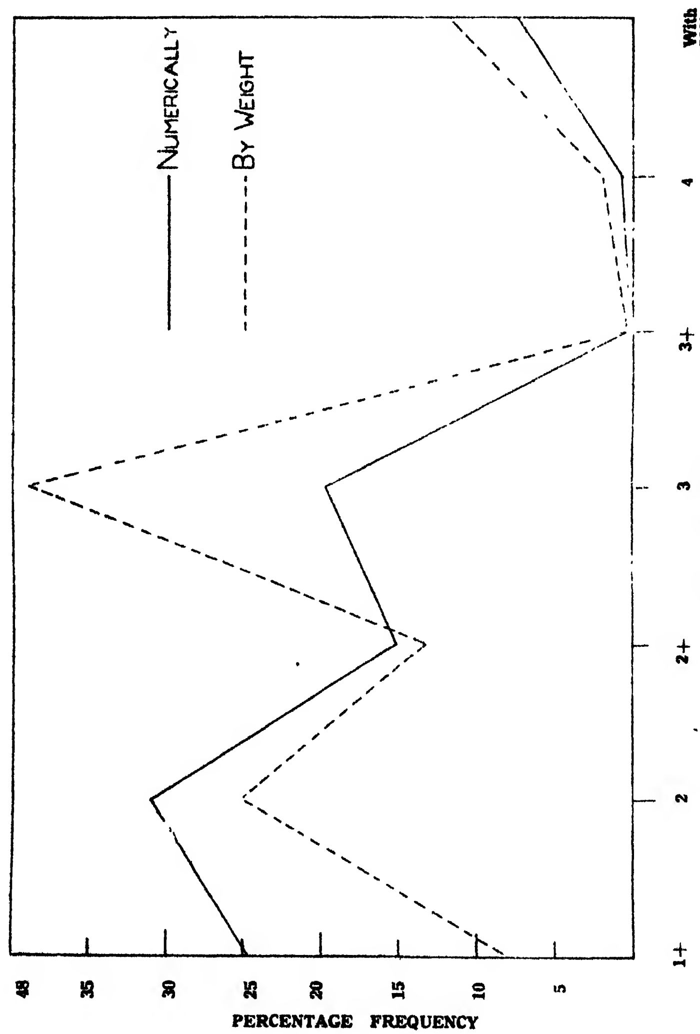


Fig. 1. Age Groups.

The high percentage of one year smolts in the previously spawned fish was mainly due to the fact that in 1928 most fish of this age group were spring fish and the number of fish which had spawned for the first time as large spring fish was higher than usual.

AGE GROUPS.

The 1,102 fish whose scales were satisfactory for age determination were classified into six groups of maiden or unspawned fish. In the following

table the fish are divided into their respective age groups (see also Table 4 Appendix).

Winters in sea ..	1 +	2	2 +	3	3 +	4	With SM's Spring Fish	With SM's Summer Fish
Percentage of Total (numerically) ..	24.73	31.02	15.18	19.85	0.05	0.71	7.38	1.08

The grilse and small spring fish (1 + and 2 winters) formed in 1928 more than half of the total catch (c.f. Went 1938 (6)). The relative importance of these age groups is not so high owing to their low average weights. By weight the large spring fish were most important representing 38.8 per cent. of the total, followed by the small spring fish representing 25.02 per cent. The relative positions of these two groups in the River Shannon changed from 1927 to 1928. The proportion of each age group by weight is given in the following table.

Winters in the sea ..	1 +	2	2 +	3	3 +	4	With SM's
Percentage by weight ..	8.1	25.02	13.3	38.8	0.08	2.00	12.70

The net and rod fisheries in the River Shannon mainly depended in 1928 on the large and small spring fish. The high average weight of the fish from this river is dependent on the high percentage of large spring fish and also on the high condition coefficient of the fish.

A graphical representation of the relative importance of the various age groups numerically and by weight is given in Fig. 1.

As is usually the case very few summer fish were taken in April; they formed a big proportion of the catch in May and in June and July they predominated. The percentage of each age group in each month is given in Table 4 (Appendix) of which the following is a summary.

Month			Spring Fish	Summer Fish
February	..	..	100 per cent.	—
March ..	..	..	100 „	—
April ..	..	..	97.1 „	2.9 per cent.
May ..	..	..	52.6 „	47.4 „
June ..	..	..	9.6 „	90.4 „
July ..	..	..	0.9 „	99.1 „

This condition agreed favourably with that of 1927 but the proportion of summer fish in May, 1928, was considerably higher than that of May, 1927.

June was again the best month for grilse (85.2 per cent. of the total grilse taken) whereas the best month for small summer fish was May (72.5 per cent. of total). We, therefore, have the following sequence :—

February and March, slightly more than half the catch is made up of large spring fish with the remainder made up of small spring fish with a small proportion of previously spawned fish.

April, as for February and March but the numbers of small spring fish are now in excess of those of large spring fish and a few small summer fish have arrived.

May, as in April but with small summer fish increasing in numbers; a few previously spawned summer fish and grilse also present.

June, grilse and small summer fish with a few spring fish and previously spawned fish.

July, almost exclusively grilse. Out of the total catch 8.46 per cent. of the fish had previously spawned and out of 116 fish of this age group only one had spawned twice.

The proportion of previously spawned fish in the months from February to April inclusive was unusually high (Table 4 Appendix). In the River Shannon the spawning season of 1926-27 was exceptionally good and it might, therefore, be expected that the number of previously spawned spring fish in 1928 which had spawned for the first time in the season 1926-27 would be greater than usual. These fish exhibited the long absence habit. Similarly the fish exhibiting the short absence habit in 1927 had previously spawned in the season 1926-27 and, therefore, were probably more abundant than in a normal year. However, since these investigations were only started on a large scale on material collected from 1927 onwards this fact could not be verified but it is probable that, both in the year under review and in 1927, the proportion of previously spawned fish was higher than normal.

As was mentioned in a previous paper, (Went, 1938 (6)), the determination of the age at first spawning is liable to some inaccuracy after the formation of the spawning mark and the return to the river as a clean fish, as erosion may remove traces of winter and summer growth. The following table gives the correlation between the age at first spawning and the absence. Owing to the difficulty in assessing the age at first spawning the figures must be regarded as approximate only. Erosion of the scales is not usually very extensive in River Shannon salmon.

Absence	Sea Winters 1+	2	2+	3	Total
Short	5	—	1	—	6
Long	19	75	1	7	102
Very Long	4	—	2	—	6
Total ..	28	75	4	7	114

Usually there is a tendency for the summer fish to return after a short or very long absence. As in the catch of 1927 a fairly large proportion of the fish, which it was estimated had spawned for the first time as grilse, exhibited the long absence habit.

The single fish which had previously spawned twice is worthy of mention. It was hatched in the spring of 1921 and had descended to the sea as a smolt in 1922. It returned to the river as a small spring fish in 1924, spawned in the season 1924-25, and descended as a kelt in 1925. It returned to the river in 1926 and spawned again in the 1926-27 season and again descended to the sea. After a long absence it returned to the river for the third time in May, 1928. At that time it weighed 17¾ lbs. and had a length of 34.7 inches.

DIVIDED MIGRATION AND RETURN.

Table 6 (Appendix) gives the years in which the fish were hatched. In this table percentages have been used since the results have been derived from the weighted figures as described in the introduction. The catch in 1928 was made up of six year classes namely those from 1921 to 1926 inclusive. The year class 1924 represented nearly 47 per cent. of the total and the two year classes 1923 and 1925 were represented by 19.47 per cent. and 24.8 per cent. respectively. The 1923 year class was much more important commercially as it contained the majority of the heavy large spring fish. Fig. 2 illustrates graphically the percentage frequency of the various year classes.

For comparison the corresponding values for the 1927 catch are given, these values being taken from a previous publication, (Went, 1938 (6)). In the years 1927 and 1928 four year old fish formed a bigger percentage of the catch than any other group. As will be seen from Table 6 the four year old fish in 1928 were made up of five different age groups namely, 1+, 2, 2+, 3 and those with spawning marks on their scales. The four and five year old fish in 1928 formed a bigger proportion of the catch than in 1927 but the three year olds were considerably decreased.

SIZE DISTRIBUTION.

Fig. 8 shows graphically the number of fish in each class interval of one inch in the sample at my disposal and has been drawn from data given in Table 7 (Appendix).

The frequency distribution curve (Fig. 3) shows three distinct modes

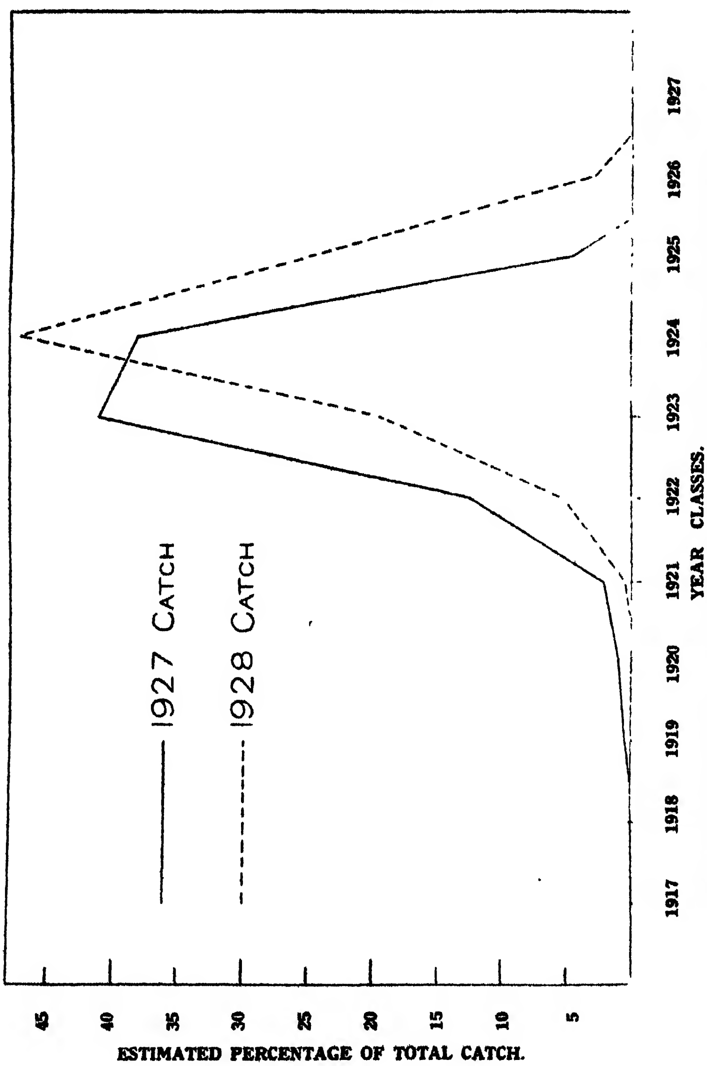


Fig. 2. Estimated percentage of the different year classes in the catches of 1927 and 1928.

corresponding with the grilse, small and large spring fish respectively and the appropriate curves for each of these age groups have been added to the diagram. It might be mentioned here that the curves given in Fig. 8 deal only with the samples at my disposal and do not show the actual distribution of sizes in the catch. The actual distribution curve would show a much more pronounced mode corresponding to the grilse than those seen in Fig. 8.

Ignoring the grilse, since their numbers are too small to be really significant, and the previously spawned fish, since this age group consists of a heterogeneous collection of fish having only one common property, namely the presence of spawning marks on their scales, it is obvious from Fig. 8 that the three most important age groups present in the samples for 1928 have

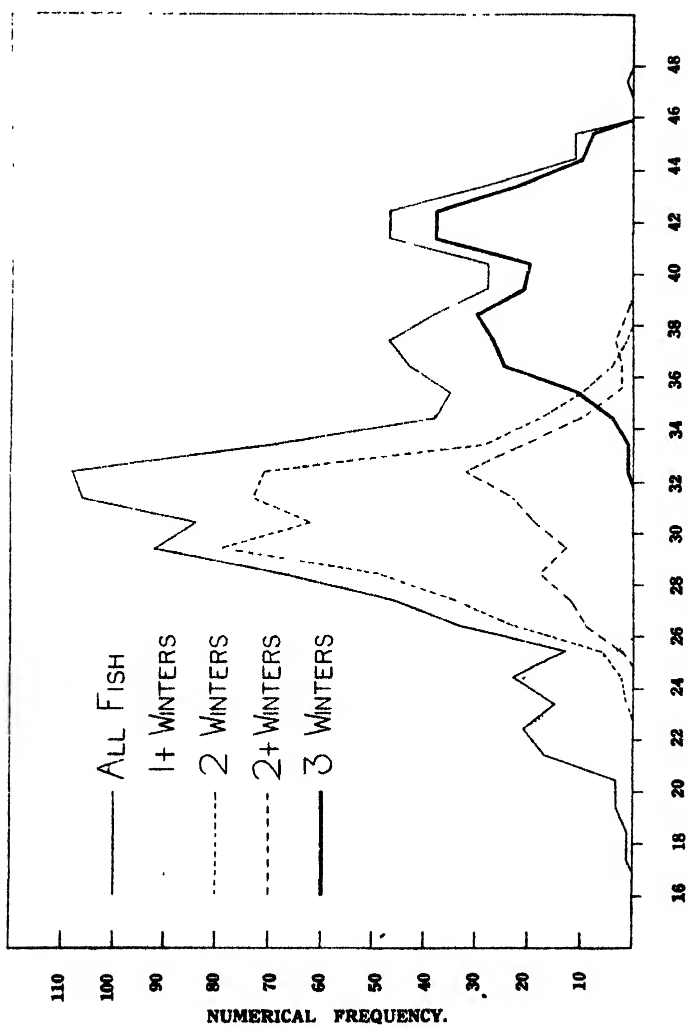


Fig. 3.

bimodal frequency distribution curves. This will be discussed at greater length in another section dealing with the size differentiation in the sexes.

AVERAGE SIZES.

Monthly details of the average weights and lengths will be found in Table 8 (Appendix) from which the necessary details have been extracted.

(1) Grilse (1 + Winters)

Total number examined - 84.

	lbs.	inches
Minimum	2.0	17.5
Average	4.94	22.62
Maximum	7.38	25.1

The first grilse was taken on the 9th May and was 24.7 inches long and 6½ lbs. weight. The female fish of the minimum weight and length was taken on the 20th June whilst the fish having maximum weight and length, which was a male, was taken on the 18th of the same month.

In 1928 the grilse were nearly a pound less in average weight than in 1927 and from the records of the Lax Weir Fishing Company it is evident that this average weight was the lowest for many years. The sex of 79 fish was noted and 59 or 74.7 per cent. were females. Of 84 grilse 10 (11.9 per cent.) were derived from one year smolts, 69 (82.2 per cent.) were derived from two year smolts and 5 (5.9 per cent.) were derived from 3 year smolts. The table gives the average weight and length in the different smolt classes. The fish derived from one year smolts were slightly longer than those of the other two smolt classes.

Smolt age	1	2	3
Average weight in lbs. ..	5.13	4.88	4.77
Average length in inches ..	22.9	22.58	22.6

but the number of the individuals examined is too small for the results to be really significant.

(2) Small Spring Fish (2 Winters).

Total number examined .. .. 467.

	lbs.	inches
Minimum	5.13	23.7
Average	12.31	30.78
Maximum	28.0	37.1

The average weight in 1928 was over 2 pounds less than that in 1927. The fish (female) of minimum weight and length was taken on the 10th May. The largest fish was taken on the 16th February. The fish in the first part of the season were on the average slightly larger than those taken in May.

The sex of 463 fish was noted and 318 or 68.6 per cent. were females. Of 467 small spring fish 44 (9.2 per cent.) were derived from one year smolts, 414 (88.9 per cent) from two year smolts and 9 (1.8 per cent.) from 3 year smolts.

The table below gives the average weight and length in the different smolt classes.

Smolt age	1	2	3
Average weight in lbs. ..	10.91	12.43	13.80
Average length in inches ..	29.53	30.93	31.00

There is a rise in average weight and length with increase in smolt age but the increase in weight is greater than would be expected from the increase in length hence the condition coefficient has risen in the same order.

(3) Small Summer Fish (2 + Winters).

Total number examined, 167.

	lbs.	inches
Minimum	7¾	25.1
	5⅞	25.2
Average	13.34	31.45
Maximum	23⅞	38.1
	25¼	36.7

The fish having the minimum length (25.1 inches) was taken on the 15th May whilst the fish of minimum weight 5⅞ lbs. was taken on the 17th May. The fish of maximum length was taken on the 24th April and that of maximum weight on the 1st May. The fish of minimum size were described as females whilst the largest fish were described as males. There was a decrease in average weight and length and incidentally of condition coefficient from April to June. The lighter fish were taken towards the end of the run.

The sex of 164 fish was noted and 91 (57.3 per cent.) were females. Of 167 small summer fish 18 (10.8 per cent.) were derived from one year smolts, 148 (88.6 per cent.) from two year smolts and 1 (0.6 per cent.) from a three year smolt.

The small summer fish in 1928 were just over a pound less in weight than those of 1927 but they differed from the 1927 fish in that they were considerably superior in weight to the spring fish of the same year, class or brood.

The table below gives the average weight and length in the different smolt classes.

Smolt age	1	2
Average weight in lbs.	10.9	13.65
Average length in inches ..	29.8	31.66

Fish of the one year smolt class were on the average smaller than those of the two year smolt class.

(4) Large Spring Fish (3 Winters).

Total number examined, 257.

	lbs.	inches
Minimum	18⅝	32.7
Average	29.78	40.01
Maximum	48⅜	45.7

The female fish of minimum weight and length was taken on the 14th February. The maximum length was recorded on two occasions, namely the 24th April and the 16th May, but the latter was nearly 7 pounds heavier than the former.

The sex of 230 fish was noted and 97 (42.2 per cent.) were females. Of 257 large spring fish 53 (20.6 per cent.) were derived from one year smolts, 199 (77.5 per cent.) were derived from 2 year smolts and 3 (1.9 per cent.) from 3 year smolts. The table below gives the average weights and lengths in the different smolt classes.

Smolt Age	1	2	3
Average weight in lbs. ..	27.03	30.06	27.28
Average length in inches ..	39.08	40.19	39.44

The fish of the two year smolt class were superior to those of the one and three year smolt classes. The large spring fish of 1928 were on the average over a pound heavier than those of 1927 but both the minimum and maximum sizes were lower in 1928 than in 1927.

(5) Large Summer Fish (3 + Winters).

Total number examined, 1.

The single fish of this age group examined was a female having a weight of 21.5 lbs. and a length of 36.3 inches and was taken on the 10th May. It was derived from a three year old smolt.

(6) Very Large Spring Fish (4 Winters).

Total number examined, 7.

	lbs.	inches
Minimum	39¼	41.7
Average	41.8	44.2
Maximum	56⅝	47.3

The fish having the smallest weight and length was a female taken on the 12th February. The biggest fish was a male taken on the 23rd March. The sex of 7 fish was noted and 6 were males. Of 7 very large spring fish one only was derived from a one year smolt and the remainder from two year smolts.

(7) Previously Spawned Fish (with S.Ms).

This age group is a heterogeneous collection of fish, having in general only one common property, namely, the presence of one or more spawning marks on their scales. The average sizes are of little value but the fish can be best classified as follows : —

on (*a*) Absence
and (*b*) Age at first spawning.

This classification gives a slight check on the estimation of the age at first spawning.

Short Absence.

Estimated age at first spawning	lbs.	inches
1 + Winters	10.50	28.2 (4 only)
2 + Winters	22.00	35.4 (1 only)

Long Absence.

Estimated age at first spawning	lbs.	inches
1 + Winter	13.61	31.71*
2 Winters	24.48	37.27*
2 + ,, ...	21.75	35.60 (1 only)
3 ,, ...	32.47	41.33 (7 only)

Very Long Absence.

1 + Winters	18.41	34.35 (4 only)
2 + Winters	24.75	37.4 (1 only)

Only the groups marked * have many individuals present. The general tendency is for fish having the long or very long absence habit to be superior in average weight and length to those having the short absence in the same age group at first spawning. The effect of spawning on the growth rate can be illustrated by comparing previously spawned fish with maiden fish of the same age. In the following table a comparison is made between fish spawning for the first time as small spring fish and having the long absence habit, and very large spring fish.

Age Group	Average Weight in lbs.	Average Length in inches
.2 S.M.1	24.48	37.27
.4	41.80	44.0

Although in the case cited the ages of the two groups are the same the period of feeding in the sea is different in each case being 3 and 4 years respectively. Whilst in fresh water a salmon loses condition in preparing to spawn. Frequently a fish will lose 30 per cent. of its weight in this way. This weight in the case of a fish regaining the sea after spawning must be made up before actual increase in weight can occur.

(8) Comparison of Average Sizes with those of 1927.

The grilse, small spring fish and small summer fish were inferior in average weight in 1928 to those of 1927 by nearly one pound, over two pounds and over one pound respectively. The large spring fish, however, were on the average somewhat over a pound heavier than the fish of 1927.

Proportion of the Sexes in each Age Group.

Table 9 (Appendix) of which the following is a summary gives the percentage of females in each month's catch in each age group.

Age Group	1 +	2	2 +	3	4	With S.Ms	Total
Percentage Females ..	74.7	68.6	57.3	44.2	14.3	52.2	63.41

In the group of maiden or unspawned fish there is a decrease in the proportion of females with increase in age. In the previously spawned fish the percentage of males appears to be very high. It should be mentioned that the determination of the sex by external examination is not at all satisfactory, particularly in the case of previously spawned fish in this river because many of the females appear to have male characteristics, so that the proportion of males given is probably too high. The sex was recorded in 1,061 fish and out of these 628 (59.2 per cent.) were females. In the previous table the value of 63.41 per cent. was derived from the weighted figures for the catch as determined from the age investigations taken in conjunction with the confidential returns from the Lax Weir Fishery for 1928.

In the grilse, small summer and large spring fish, the proportion of females decreased as the season progressed but in the remaining age groups the proportions fluctuated erratically. The number of fish derived from 3 year smolts was very small so they can be ignored. In the remaining two smolt classes it will be seen that the percentage of females is lower in the 2 year smolt class than in the one year smolt class of the same age group.

Size Differentiation in the Sexes.

In the section dealing with average sizes it will be seen that in every age group which has a fairly large number of individuals present the fish having the minimum weights and lengths were females, whilst those having the maximum weights and lengths were males. It was mentioned previously that there was a bimodal appearance to the frequency distribution curves in some age groups. In a previous publication (Went, 1938 (6)) it was shown that the bimodal appearance of the frequency distribution for the large spring fish in 1927 was due to the heterogeneous condition of the material, namely, the collection together of the males and females each of which had normal distribution curves when treated separately. Table 10 (Appendix) gives the average weights and lengths of the males and females in all homogeneous age groups having sufficient numbers to give significant means.

(*a*) Grilse.

The males were on the average 1.2 inches longer and 0.87 lbs. heavier and slightly superior in condition than the females. The number of grilse examined from this year's catch was very small and for this reason they were not divided into their constituent smolt classes.

(*b*) Small Spring Fish.

The average weight and length of the males was $2\frac{3}{4}$ lbs. and 1.7 inches higher than those of the females and the condition of the females was inferior to that of the males. It can be shown that the bimodal appearance of the frequency distribution curve for this age group is due to the collection together of the males and females.

(*c*) Small Summer Fish.

The average weight and length of the males was nearly 3.7 lbs. and 3.4 inches higher than those of the females.

(*d*) Large Spring Fish.

The average weight and length of the males was about $2\frac{3}{4}$ lbs. and $2\frac{3}{4}$ inches higher than that of the females but the average condition coëfficient was much higher in the case of the females. Again the bimodal appearance of the frequency distribution curve can be shown to be mainly due to the collection together of the males and females.

(*e*) Size Differentiation in the Sexes and in the Smolt Classes.

In a previous section it was mentioned that there was a difference in the average weights and lengths in the different smolt classes which made up the age group. In Table 10 (Appendix) the small and large spring fish have been separated into their respective smolt classes within each sex and in every case the females of a particular smolt class were smaller on the average than the males of the same class.

Condition Coefficient.

The condition coefficient on the relationship between weight and length is determined according to the formula

$$K = \frac{W}{L^3 X 0.00036} \quad \text{Where} \quad \begin{array}{l} W = \text{weight in lbs. and} \\ L = \text{length in inches.} \end{array}$$

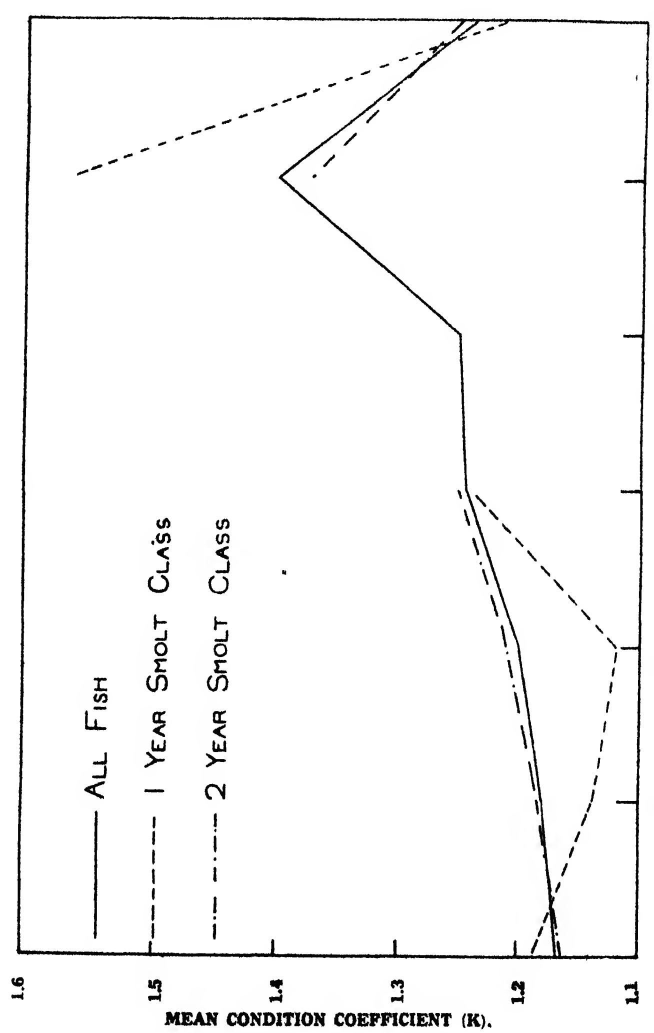


Fig. 4. Age Groups (Sea Winters).

This formula gives a figure approximating to about 1.05—1.10 for normally fed fish in Scottish rivers for which it was designed, (Menzies, 1921 (2a)) but in the case of Shannon salmon the figure obtained is nearer 1.2 than unity showing that in general fish from this river are, length for length, heavier than fish from Scottish rivers.

Another method of expressing the relationship between weight and length is by means of the condition factor according to Corbett's scale and many workers using British units prefer this to the Scottish formula. The relationship between the two values for the same individual is given by the equation.

Condition Factor (C.F.) = K (Condition Coefficient) x 36.

If a condition coefficient is calculated from the formula $\frac{100000\ W}{L^3}$ where W = Weight in Kilogrammes and L = Length in Centimetres the value obtained closely approximates to that obtained by using Menzies' formula given above.

Table 8 (Appendix) gives the average condition coefficient for the monthly catches in each age group. The mean value of the condition coefficient for the fish examined in 1928 was 1.19 (condition factor 42.8). The following table has been extracted from Table 8 (Appendix) and is graphically illustrated in Figure 4.

Age Group	Mean Condition Coefficient	Mean Condition Factor (Corbett's Scale)
1 + Winters	1.167	42.0
2 ,, ...	1.180	42.5
2 + ,, ...	1.201	43.2
3 ,, ...	1.245	44.8
3 + ,, ...	1.251 (1 individual only)	45.0
4 ,, ...	1.403 (7 individuals only)	50.5
With S.Ms.	1.239	44.6
Spring Fish	1.200	43.2
Summer Fish	1.178	42.2
TOTAL ..	1.190	42.8

The very large spring fish were in the best condition of all the age groups, followed by the large spring fish, which formed the heaviest age group in the catches of 1928. There is an increase in the condition coefficient with an increase in the time spent feeding in the sea. The spring fish are on the average in better condition than the summer fish and in this respect the salmon of the River Shannon agree with those of the Wye, (Hutton, 1937, (1), but differ from those of the Scottish rivers which have been adequately investigated. In 1928 the small summer fish had a higher average condition coefficient than the small spring fish.

In all age groups that have sufficient numbers present to give reliable means, the average condition coefficients in 1928 were, age group for age group, slightly inferior to those of 1927. The following table gives the average monthly condition coefficients.

Month	Mean Condition Coefficient	Mean Condition Factor (Corbett's Scale)
February ..	1.217	43.8
March	1.251	45.1
April	1.209	43.5
May	1.181	42.5
June	1.166	42.0
TOTAL	1.190	43.2

The average condition coefficient of the fish taken in February is lower than that of those taken in March after which there is a general decline in the value of the condition coefficient, mainly due to the influx of summer fish into the catches.

It has been mentioned that there is a difference in the average sizes of the fish in the different smolt classes belonging to the same age group. The 3 year smolt class and the 3 + and 4 Winter age groups are not very numerous and, therefore, will be ignored in the following discussion. With the exception of the grilse the one year smolt class is, age group for age group, inferior in average condition coefficient to that of the two year smolt class. In Figure 4 the curves for the average condition coefficients in the two most important smolt classes in each age group are given, the values being extracted from Table 8 (Appendix). In 1927 the average condition coefficient was lower in the one year smolt class than in the two year smolts in all the age groups except the grilse and the previously spawned fish. In 1928 the same condition prevailed except that the order was reversed in the case of the previously spawned fish. An explanation of this reversal can be given. The previously spawned fish in 1927 consisted mainly of fish which had spawned for the first time as grilse whereas in 1928 the previously spawned fish consisted largely of fish which had spawned for the first time as small spring fish.

The small and large spring fish have been divided into length groups at intervals of 2 inches and the variation of the mean condition coefficient is given in the following table :—

Class Interval	Small Spring Fish		Large Spring Fish
	February to April	May and June	
22	—	1.056 (1)	—
24	1.016	1.021 (5)	—
26	1.106	1.082	—
28	1.126	1.182	—
30	1.194	1.185	—
32	1.232	1.258	1.081 (3)
34	1.221	1.185 (6)	1.274
36	1.221 (4)	1.357 (1)	1.269
38	—	—	1.207
40	—	—	1.260
42	—	—	1.247
44	—	—	1.294

In the case of the small spring fish, there appears to be, in general, an increase in the average condition coefficient with an increase in size. This is illustrated graphically in Fig. 5. In the large spring fish the average condition coefficient rises from the 32 inch class interval to the 34 class interval, falls in the 36 and 38 class intervals and rises in the 40 class interval, falls in the 42 class interval and rises again in the 44 class interval. As mentioned previously the condition of the males is much lower than that of the females in the same length class interval. In Fig. 5 the frequency distribution curves for each sex have been given. If the sexes are separated the condition coefficient in general rises with increase in length. The fluctuating value of the condition coefficient as given in the above table can be shown to be mainly due to the grouping together of the two sexes. The fall at the 38 class interval coincides with a rise in the proportion of the males (which as explained previously have considerably lower condition coefficients than the females). After the 38 class interval, apart from the slight fall from 40 to 42 the condition coefficients roughly increase with an increase in size. In Fig. 5 only the class intervals having comparatively numerous individuals present have been given in order to facilitate the comparison.

EROSION.

As mentioned in a previous publication (Went, 1938, (6)) erosion or, more properly, absorption of the scales begins to take place when the gonads of salmon are ripening. Usually erosion takes place in fresh water but it can take place in the sea if the fish is prevented from ascending a river by low water or from other causes. Extended residence in fresh water is denoted

by a high degree of erosion on Menzies scale (Menzies, 1931 (26)). Table II (Appendix) gives the monthly mean degree of erosion and the monthly proportion of fish having eroded scales in the one and two year smolt classes in the 1 +, 2, 2 + and 3 winters age groups.

In general it will be noticed that there is an increase in both the monthly

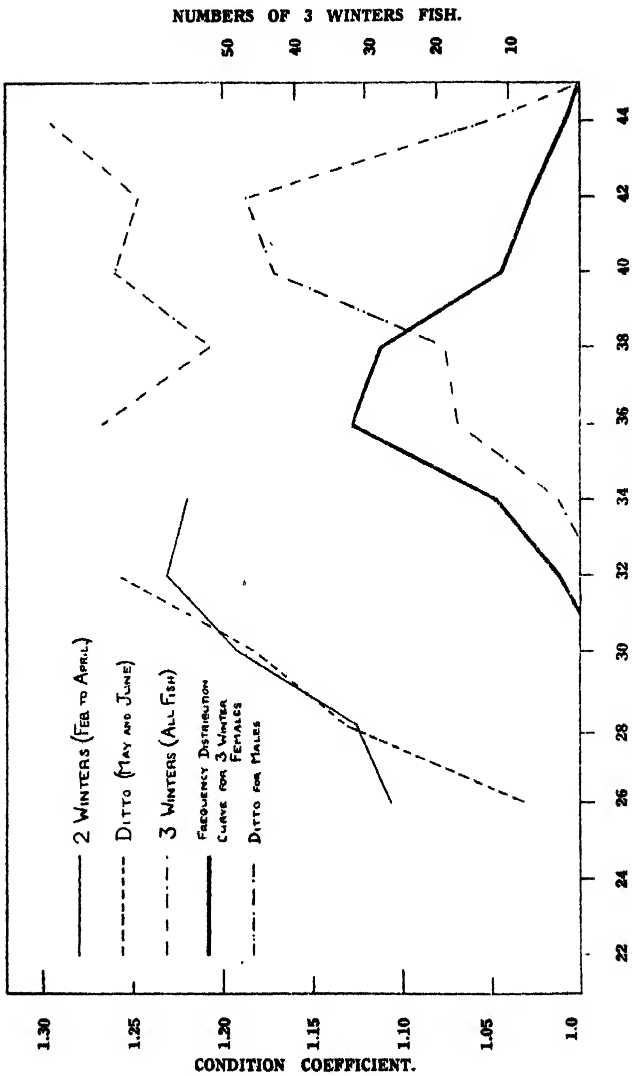


Fig. 5. Class Interval.

mean degree of erosion and in the proportion of fish having eroded scales as the season progresses. The mean degree of erosion and the proportion of fish having eroded scales is greater in the large spring fish than in any other group. The time of running of these fish is earlier than any other homogeneous group and this probably accounts for the greater erosion of the

scales. In the material at my disposal for 1928 the number of sets of scales and data for the freshwater portion of the river is somewhat limited so that it is not possible to show the effect of a sojourn in fresh water as was done in a previous publication.

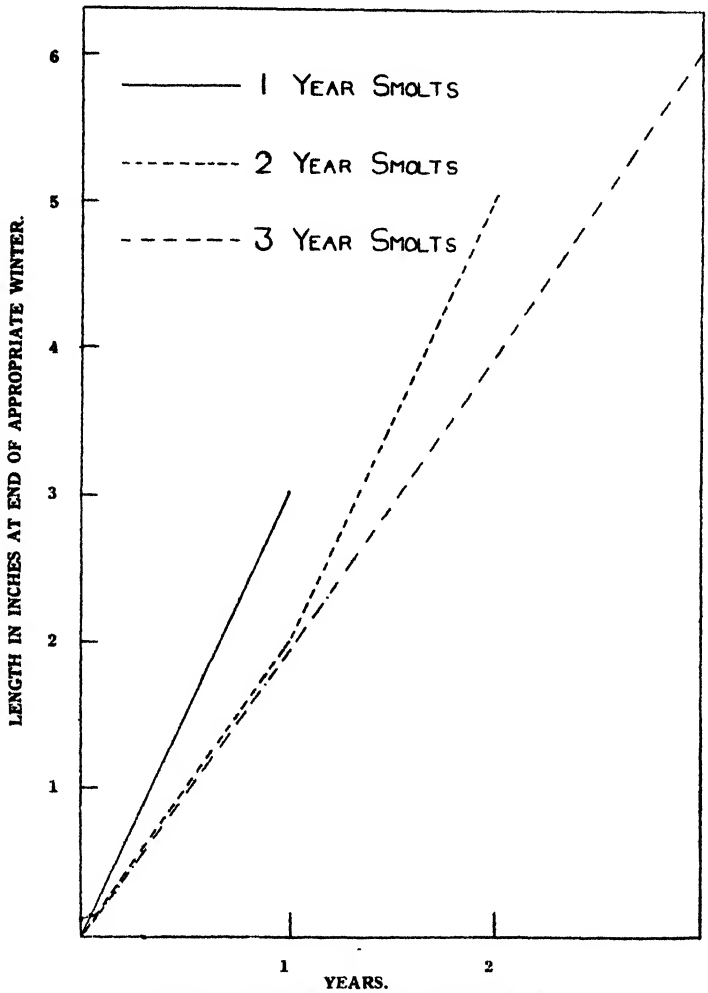


Fig. 6. Growth rate in different Smolt Classes.

Calculated Lengths.

The length of every unspawned or "maiden" fish at the end of every year of its life was calculated in the usual way, *i.e.*, by assuming that the growth of the fish is strictly proportional to the growth of the scales.

A.—RIVER LIFE.

In this section it is proposed to deal with the parr and smolt lengths and their relationships. The following table gives the growth in each smolt class.

Smolt Age	Average Length in Inches at End of			Average length in inches at end of winter prior to migration
	1st Winter	2nd Winter	3rd Winter	
1	3.02 (3.73)	—	—	3.02
2	2.00 (2.18)	5.04 (5.52)	—	5.04
3	1.98 (2.11)	3.96 (4.31)	6.03 (6.54)	6.03

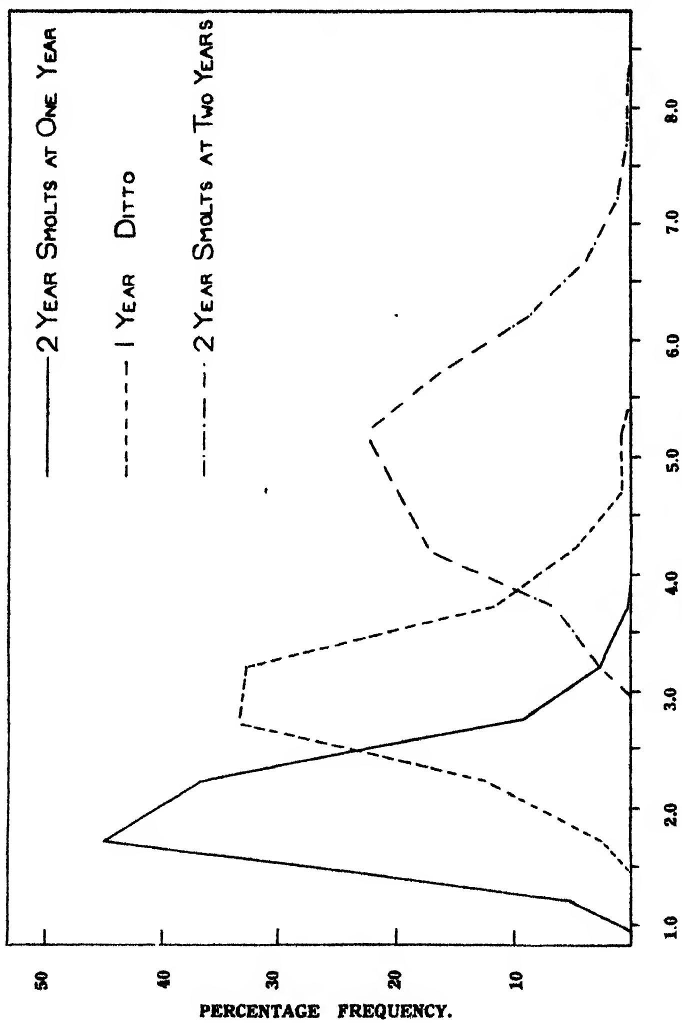


Fig. 7. Length in Inches.

The one year smolts at the end of the first winter in the river were longer on the average than the two and three year smolt classes, and the two year smolt class was similarly only slightly larger than the three year smolt class. The two year smolt class was longer on the average at the end of

the second winter in the rivers than the three year smolts. The number of three year old smolts is too small, however, to give reliable means. It is obvious that the fastest growing parr migrate to the sea first. The figures in brackets in the above table indicate the values obtained from the examination of the catches of 1927 (Went, 1938, (6)) and it will be noticed that the

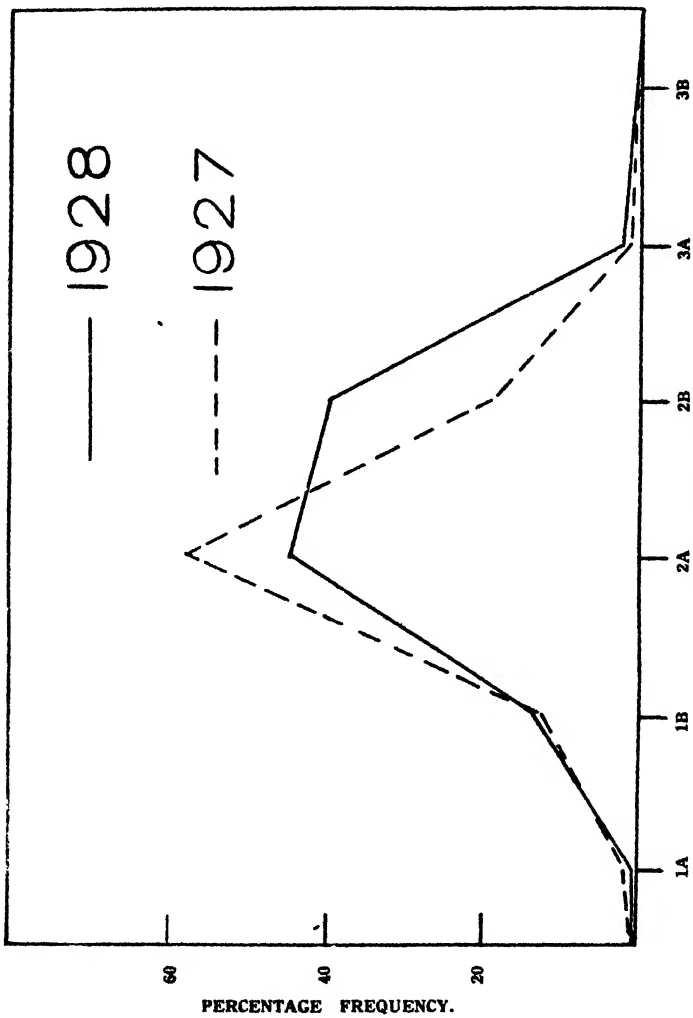


Fig 8. Smolt Type.

values obtained for the catches of 1927 were higher than for the catches of the year under review. The growth curves of the different smolt classes are given in Fig. 6. In Fig. 7 the length frequency distribution curves for the one and two year smolt classes at the end of the first river winter and the two year smolt class at the end of the second river winter are given. The percentage frequency is used in Fig. 7 in order to facilitate the comparisons.

In a previous publication (Went, 1933, (6)) it was mentioned that the fish in 1927 could be divided into two groups namely :—

(1) Those fish whose scales indicated little or no growth in the spring prior to migration as smolts. Again for convenience these fish were termed Type A smolts.

(2) Those fish whose scales indicated growth in fresh water in the spring prior to migration as smolts. These were termed for convenience Type B smolts.

It was shown also that in any smolt class the Type A smolts were longer on the average than the Type B smolts at the end of every winter in the river. Type A smolts occurred in the one year smolts only to a limited extent, Types A and B smolts were found in the two year smolt class. As the 3 year old smolts were few in number they were eliminated from the discussion and it is proposed to do so again in the discussion of the results of the examination of the catch of 1928. The table below gives the percentage occurrence in each smolt type and in brackets the equivalent values for 1927.

Smolt Age	Percentage Occurrence	
	Type A	Type B
1	0.1% (1.4)	13.4% (20.1)
2	44.3% (57.8)	39.7% (19.0)
3	2.0% (1.5)	0.6% (0.1)

The distribution of the various groups was on the same general lines in 1928 as in 1927 although the main difference was the reduction of the 2 year Type A and the increase in the proportion of the 2 year Type B smolts in 1928. (See Fig. 8). It is hoped at a future date to discuss the significance of this when the data for a number of other years are available. In the table below the mean lengths of the fish at the different years of life are given :—

Smolt Age	Length at End of First Winter		Length at End of Second Winter	
	Type A	Type B	Type A	Type B
1 ..	5.6 (1)	3.00 (119)	—	—
2 ..	2.09 (409)	1.89 (367)	5.40 (405)	4.64 (367)

It is obvious from the above table that the same phenomenon as seen in the catches of 1927 is also present here, namely, that the Type A smolts are longer at any one time than the Type B smolts of the same year class. In a previous publication (Went, 1938, (6)) it was shown that the difference between the means (from the statistical point of view) was significant, that is to say, if the number of observations was very much increased the new means would not differ so much from the figures already obtained as to approximate to one another. In the following discussion it is proposed to deal with the 2 year smolt class at the end of one and two years respectively and the Types A and B irrespective of their smolt class.

In the following table the appropriate statistical constants of the various series are given.

Group	Number (N)	Means (M)	Standard Deviation σ	Standard Deviation of the Mean $\frac{\sigma}{\sqrt{N}} = u$
2 year Type A at end of first winter	409	2.09	0.42	0.028
2 year Type B at end of first winter	367	1.89	0.34	0.018
2 year Type A at end of second winter	405	5.40	0.76	0.038
2 year Type B at end of second winter	367	4.64	0.82	0.042

Taking the 2 year Type A and 2 year Type B smolts at the end of the first winter the difference in the two means measured in terms of the standard deviation of the differences is given by

$$\frac{2.09-1.89}{\sqrt{0.028^2+0.018^2}} = \frac{0.20}{0.0333} = \underline{6.0}$$

Similarly taking the other two pairs of observations, namely, those for the 2 year Type A and the 2 year Type B smolts at the end of the second winter, the difference in the two means measured in terms of the standard deviation of the differences

$$=13.42$$

Both the above differences are statistically significant.

In Fig. 9 the frequency distribution curves for the 2 year smolts, Types A and B, at the end of the first and second winters and of the one year Type B smolts at the end of the first winter are given. As mentioned in a previous publication it is possible to calculate the size of the smolt in the Type B smolts as there is a fairly clear distinction between the river and sea growth. The degree of accuracy in this case is not so high as in the previous cal-

culations as often an intermediate type of growth, presumably estuarine growth, is observed. In the following table the average sizes of the smolts in the different smolt classes are given (only groups with sufficient numbers to be significant are included) and in Fig. 10 the frequency distribution curves are given.

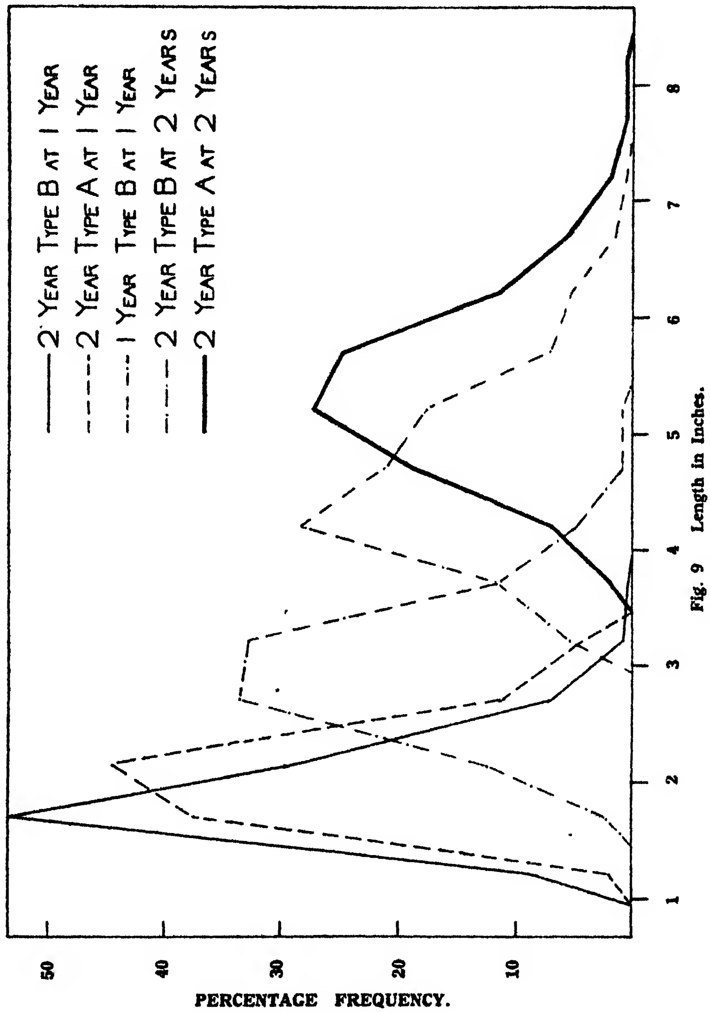


Fig. 9

Smolt Age	Mean Size of the Smolts in Inches	
	Type A	Type B
1	—	4.73
2	5.40	5.76
All ages	5.40	5.64

The mean size of all the smolts was 5.54 inches and in Types A and B was 5.40 and 5.64 respectively.

In a previous publication (Went, 1938 (6)) it was suggested that before the smolt migration occurs some physiological condition is attained which is associated, at least as an index, with a minimum size. This minimum

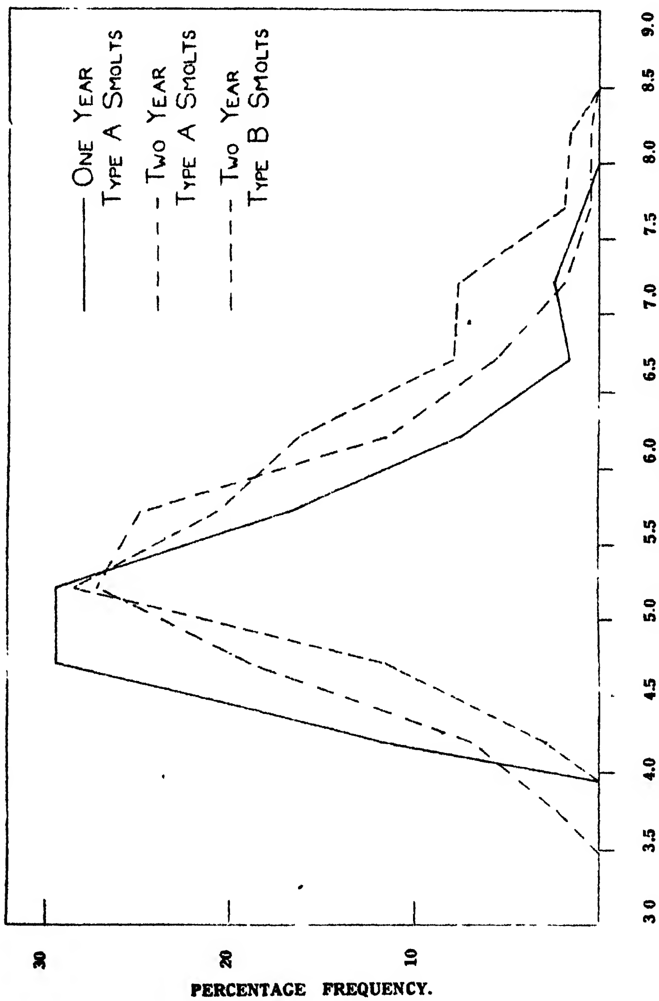


Fig. 10. Smolt Length in Inches.

size appears to be about 5.0 inches but might conceivably vary from year to year. It should be noted that the calculations of the parr and smolt sizes already made were taken from measurements of scales of adult fish derived from five different year classes, namely, those from 1922 to 1926 inclusive.

Jones and King, 1939, (3) state that it is possible in the case of the salmon

parr of the River Dee to produce in one year, by artificial feeding, parr of the estimated minimum size and that if parr of such minimum size migrate a group of one year migrants would be established.

At Adare, Co. Limerick, the Earl of Dunraven operates a salmon hatchery on the River Maigue, a tributary of the River Shannon. This hatchery is provided with a series of small feeding ponds. In 1935 a number of salmon alevins were placed in these ponds and fed artificially on an excess of liver, hard-boiled egg, etc. At the beginning of the following spring, namely, that of 1936, all the surviving fish had acquired the smolt livery and were ready to migrate. Unfortunately no measurements were made but it was said that the smolts averaged 5–6 inches in length. The salmon of the River Maigue are similar to those of the River Shannon particularly with regard to the distribution of the various smolt classes. Although the River Maigue in the natural state does not produce a big proportion of one year Type A smolts, by artificial rearing, 100 per cent. such smolts were produced. It appears, therefore, that the quantity of food available influences, first of all the growth rate and, secondly, the age at which the smolts migrate.

The results of the calculations of the smolt length, etc., made from the adult fish of 1928 agree quite closely with those made from the 1927 fish and it is not proposed to elaborate on the results any further at the present time. It is hoped that the collection of salmon smolts which was started in 1938 will reveal further information on this subject.

In the Scottish investigations (Menzies, 1931 (2)) has shown that the size of the smolts at the time of migration varies in the different smolt classes and is in the same order as the smolt age. The following table gives the relationship between the mean smolt size (in inches) and the smolt age, as calculated from adult scales from salmon of the River Shannon in 1928.

Smolt Age	Mean Smolt Size
1	4.75
2	5.57
3	6.64

It can be seen that a similar condition to that mentioned above is found in salmon of the River Shannon. If the smolt classes are divided into their respective types the results are as follows :—

Smolt Age	Mean Smolt Size
1 year Type B ..	.. 4.75
2 years Type A ..	.. 5.40
2 „ Type B ..	.. 5.76
3 „ Type A ..	.. 5.82
3 „ Type B ..	.. 7.12 (5 individuals only).

The same order of mean size is seen but the Type A smolts are slightly smaller than the Type B smolts of the same smolt class. It is proposed in a later part of this section to discuss the question of the mean size of the smolts in the different age groups.

In the following table the average sizes in inches at the end of the first winter in the river are given for each smolt class and in each age group.

Smolt Age	Age Group						All Age Groups
	1+	2	2+	3	3+	4	
1	3.3 **3.86**	2.8 **3.87**	2.7 **3.80**	3.30 **3.30**	—	(2.6)	3.02
2	2.1 **2.26**	1.95 **1.92**	1.95 **2.15**	2.06 **2.24**	—	(2.4)	2.00
3	(2.1)	(1.9)	(1.9)	(2.1)	(1.8)	—	1.98

The figures given in brackets indicate that the numbers are too few to be significant and those figures in heavy type indicate the appropriate figures obtained from the examination of the 1927 catch. There appears to be little differentiation between the mean size at the end of the first year in the river in the different age groups. It is quite possible, however, that any differentiations which might occur in fresh water would not be evident at the end of the first year in the river and in the following table the average sizes of the smolts in the different age groups are given. The figures in brackets show the number of individuals examined when such numbers are small.

Smolt Age	Age Group					
	1+	2	2+	3	3+	4
1 ..	5.85 (10)	4.92	4.92 (17)	5.30	—	5.2 (1)
2 ..	5.78	5.33	6.25	6.02	5.5 (1)	6.4 (5)
3 ..	6.90 (5)	5.93 (9)	5.4 (1)	6.54 (5)	—	—
Total	5.82	5.31	6.08	5.87	5.5 (1)	6.2 (6)

Taking the spring and summer fish separately there is an increase in the mean size of the smolt with an increase in the time spent feeding in the sea (age group). The mean size of the smolt appears to be smaller in the spring fish than in the summer fish of the same and preceding year classes.

B.—SEA LIFE.

In this section it is proposed to deal with the relationships of the lengths at the end of the various sea years.

(1) Grilse (1 + Winters).

In the following table the mean lengths at the end of the first sea winter are given.

Smolt Age	Mean Length at end of 1st Winter in the Sea	Mean Length at end of Winter prior to migration as a Smolt	Mean Smolt Size	Tota Increment in 1st Sea Year	Increment made in Sea
1	17.34 (10)	3.26	5.85	14.08	11.49
2	17.30 (69)	5.18	5.73	12.12	11.57
3	18.02 (5)	6.70	6.90	11.32	10.44
TOTAL ..	17.35 (84)	5.04	5.82	12.31	11.53

The mean lengths in the one and two year smolt classes are approximately the same at the end of the first sea winter. However, the increment made in the sea in that year by the one year smolt class is slightly less than that made by the two year smolt class. If, however, we take the increment made between two successive winters into consideration it is found that when the fish are arranged in ascending order of smolt ages, then the increment decreases. This can be readily explained as the one year smolts make on an average about 2 inches growth in the spring prior to migration to the sea. In the last column but one of the above table this increment has been included whereas in the last column only the actual growth made in the sea is given. It is probable that the Type B smolts of each smolt class migrate later in the year than the Type A smolts, so that although the growth in the sea is approximately the same in the one and two year smolt classes, the growth rate in the one year smolt class in the first year in the sea is considerably superior to that of the two year smolt class owing to the smaller period of actual residence (one year smolts being mainly of type B) in the sea during that period. Although the one year smolt class at the end of the winter prior to migration to the sea is on the average nearly two inches smaller than that of the two year smolt class at the same time, by the end of the first winter in the sea the one year smolts have equalled the two year smolts in size.

(2) Small Spring Fish (2 Winters).

The mean lengths at the end of the first sea winter in the various smolt classes are given in the following table.

Smolt Age	Mean Length at end of 1st Winter in Sea	Mean Length at end of Winter prior to Migration as Smolt	Mean Smolt Size	Total Increment in 1st Sea Year	Increment made in the Sea	Increment in 2nd Sea Year
1	17.40	2.84	4.92	14.56	12.48	12.18
2	18.05	4.98	5.33	14.07	12.72	12.88
3	18.87	5.73	5.93	13.14	12.94	12.13
TOTAL	18.00	4.78	5.31	13.22	12.69	12.78

The mean lengths of the fish increase with a rise in smolt age. The increment in the first sea year, part of which only is made in the sea in the type B smolts decreases with a rise in the age of the smolt. The actual growth made in the sea during this year corresponds with the order of the smolt classes. On an average the one year smolts at the end of the first year in the sea have spent less time feeding in the sea than the two year smolts since there is a bigger proportion of type B smolts in the one year smolt class than in the two year smolt class.

(3) Small Summer Fish (2 + Winters).

The mean lengths at the end of the first and second sea winters are given in the following table.

Smolt Age	Mean Length at end of 1st Winter in Sea	Mean Length at end of 2nd Sea Winter	Mean Length at end of Winter prior to migration as Smolt	Mean Smolt Size	Total Increment in 1st Sea Year	Increment actually made in Sea	Increment in 2nd Sea Year
1	16.30	27.6	2.68	4.92	13.62	11.38	11.30
2	17.70	29.60	4.78	6.25	12.92	11.45	11.90
Total	17.52	29.40	4.62	6.08	12.98	11.44	11.80

The mean lengths at the end of the first sea winter are higher in the two year smolt class than in the one yéar smolt class. The total increment made in the second year of life in the one year smolt class is greater than that made in the third year of life in the two year smolt class. During this year, however, the two year smolt class made slightly more actual sea growth. The increment made by the two year smolts in the second sea year is higher than that made by the one year smolt class.

(4) Comparison Between the Small Spring and Summer Fish.

The lengths at the end of the first sea winter in the small summer fish were, on the average, considerably lower than those of the spring fish of the same class. A similar state of affairs was seen at the end of the second sea

winter so that these fish having the maximum size in this particular group of fish return to the rivers before the smaller members. The increment made in the second sea year was higher in the case of the small spring fish than in the case of the small summer fish. Similarly the increment made in the year of migration as a smolt is greater in the spring fish than in the summer fish.

(5) LARGE SPRING FISH.

In the following table the mean lengths of the fish at the end of the first and second winters in the sea are given.

Smolt Age	Mean Length at end of 1st Sea Winter	Mean Length at end of 2nd Sea Winter	Mean Length at end of Winter prior to Migration as Smolts	Mean Smolt Size	Increment in 1st Sea Year	Actual Increment in the Sea	Increment in 2nd Sea Year	Increment in 3rd Sea Year
1 ...	18.3	30.97	3.28	5.30	15.02	13.0	12.67	8.11
2 ..	19.13	32.90	5.28	6.02	13.85	13.11	13.77	7.29
3 ...	19.75	31.70	6.24	6.54	13.51	13.21	11.95	7.74
TOTAL ...	18.95	32.23	4.86	5.87	14.09	13.08	13.28	7.78

At the end of the first, second and third sea winters the two year smolt class was superior in mean lengths to that of the one year smolt class. The actual increments made during the year ending with the first post-migration winter were less in the case of the two year smolts than in the one year smolts although the growth during that period actually made in the sea was almost equal in the two cases. The mean increment made in the second sea year by the two year smolts is just over one inch more than in the one year smolt class.

(6) LARGE SUMMER FISH.

Only one example of this age group was found and the calculated lengths were as follows.

Length at end of first sea winter = 19.6 inches
,, ,, second ,, = 27.8 ,,
,, ,, third ,, = 33.7 ,,

(7) VERY LARGE SPRING FISH.

The growth rate of the fish in this age group is given in the following table.

	Smolt Age		
	1	2	TOTAL
Length at end of 1st Sea Winter	18.8	18.9	18.9
Length at end of 2nd Sea Winter	31.0	27.5	28.20
Length at end of 3rd Sea Winter	41.0	35.9	36.8
Length at end of 4th Sea Winter	47.8	43.2	44.2

C.—CORRELATION TABLES.

In this section it is proposed to investigate the relationship between the growth in the various years of life.

(1). Correlation between lengths at end of first and second winters in the two year smolt class :—

The following table gives the correlation between the length of the parr at the end of the first and second winters in the two year smolt class :—

Length at end of 1st Winter in Inches	AGE GROUP														
	1+ Winters			2 Winters			2+ Winters			3 Winters			All Fish		
	No.	Mean Length	Mean Increment	No.	Mean Length	Mean Increment	No.	Mean Length	Mean Increment	No.	Mean Length	Mean Increment	No.	Mean Length	Mean Increment
1.0—1.4	1	4.3	3.1	24	3.95	2.75	6	4.63	3.43	10	4.17	2.97	41	4.06	2.86
1.5—1.9	26	4.57	2.87	192	4.63	2.93	79	4.53	2.83	43	5.12	3.42	340	4.80	3.10
2.0—2.4	9	5.46	3.26	138	5.37	3.17	50	5.20	3.00	73	5.47	3.27	274	5.38	3.18
2.5—2.9	9	5.95	3.25	29	5.57	2.87	7	5.59	2.89	28	6.22	3.52	74	5.83	3.13
Over 3.0	4	6.35	—	8	6.52	—	1	4.4	—	4	6.6	—	17	6.45	—

In general the parr which are longest at the end of the first winter are longest at the end of the second winter. The mean increment made in the second year, however, varies only slightly in the different class intervals so that speaking generally the difference in size at the end of the second year is due mainly to the different growth rates in the first year. The results given above are of the same order as those determined for the 1927 fish and the conclusions to be drawn therefrom are the same.

(2). Correlation between the length of the smolt and the length at the end of the first sea winter :—

The following table gives the correlation between the smolt length and the length of the fish at the end of the first sea winter in the one year and two year smolt classes :—

One Year Smolt Class (All Age Groups).

Length of Smolt	No.	Mean Length at end of 1st Sea Winter	Mean Increment made in Sea in 1st Year
3.0—3.9	2	17.3	—
4.0—4.9	48	16.75	12.3
5.0—5.9	56	17.70	12.25
6.0—6.9	11	18.93	12.48
7.0—7.9	3	18.40	—

Two Year Smolt Class.

Length of Smolt in Inches	Age Groups: 1+ No.	1+ Average Length	2 No.	2 Average Length	2+ No.	2+ Average Length	3 No.	3 Average Length	Total No.	Total Average Length	Total Mean Increment in Sea in 1st Year
8.0—3.9	1	14.7	3	17.1	1	15.4	—	—	5	16.3	12.8
4.0—4.9	9	16.7	28	16.7	36	16.9	10	17.8	90	17.7	12.5
5.0—5.9	35	17.1	219	18.2	81	17.6	65	18.7	403	18.1	12.5
6.0—6.9	16	18.0	59	18.6	25	18.5	54	19.1	154	18.7	12.2
7.0—7.9	7	18.4	12	19.5	2	19.1	26	20.3	47	19.8	12.3
8.0—8.9	—	—	1	20.1	—	—	—	—	1	20.4	12.0

It is obvious that the longest smolts give rise to the longest fish at the end of the first sea winter. The mean increment made in the sea in the one year smolt is approximately the same as that in the two year smolt class. As, however, the one year smolt class spend less time in the sea in the first year than the two year smolt class and therefore, the first year sea growth rate in the one year smolt class is considerably higher than that of the two year smolt class.

The above tables suggest that the size of the smolt has little or no effect on the growth rate in the first sea year.

(3). Correlation between the lengths at end of first and second winters in the 2, 2+ and 3 winters age groups :—

The following table gives the correlation between the lengths at the end of the first and second sea winters in the one and two year smolt classes :—

Length at end of 1st Sea Winter in Inches	Smolt Age: One Year, All Age Groups: No. of Fish	One Year, All Age Groups: Mean Length at end of 2nd Sea Winter	Two Years, 2: No. of Fish	Two Years, 2: Mean Length at end of 2nd Sea Winter	Two Years, 2+: No. of Fish	Two Years, 2+: Mean Length at end of 2nd Sea Winter	Two Years, 3: No. of Fish	Two Years, 3: Mean Length at end of 2nd Sea Winter	Two Years, All Age Groups: No. of Fish	Two Years, All Age Groups: Mean Length at end of 2nd Sea Winter	All Smolts, All Age Groups: No. of Fish	All Smolts, All Age Groups: Mean Length at end of 2nd Sea Winter
12.0—13.9	—	—	2	23.9	1	23.2	—	—	3	23.6	3	23.6
14.0—15.9	14	26.9	33	27.9	18	26.3	2	27.8	53	27.3	67	27.2
16.0—17.9	53	28.7	139	29.3	65	28.4	20	29.5	226	29.0	282	28.9
18.0—19.9	40	31.2	171	31.4	52	32.1	80	31.4	305	31.5	343	32.3
20.0—21.9	6	34.5	42	33.3	6	32.6	57	33.5	106	33.4	115	33.4
22.0—23.9	—	—	2	35.8	—	—	5	35.4	7	35.9	7	35.9
24.0—25.9	—	—	—	—	—	—	1	34.4	1	34.4	1	34.4

It is obvious that fish which are the longest at the end of the first sea winter have the greatest length at the end of the second sea winter. The increments

made in the second sea year by fish of any one class interval in the one year smolt class is slightly less than that made by the two year smolt class during the same period. Generally the increments made by fish of the 2 + winters age group are less, length for length, than those of the 2 and 3 winters age group.

(4) Correlation between the lengths at the end of second and third sea winters in the 3 winters age group :—

The following table gives the correlation between the lengths of fish at the end of the second and third winters in the sea in the 3 winters age group :—

Length at end of 1st Sea Winter in Inches	SMOLT CLASS					
	One Year Smolt Class		Two Year Smolt Class		All Smolt Classes	
	No. of Fish	Mean Length at end of 3rd Sea Winter	No. of Fish	Mean Length at end of 3rd Sea Winter	No. of Fish	Mean Length at end of 3rd Sea Winter
26.0—27.9	6	35.8	8	35.1	14	35.4
28.0—29.9	9	37.0	27	37.0	37	37.0
30.0—31.9	19	38.9	39	38.8	60	38.8
32.0—33.0	12	42.1	58	43.0	72	42.8
34.0—35.9	3	42.5	28	42.8	31	42.8
36.0—37.9	1	42.4	4	44.8	5	44.4
38.0—39.9	—	—	1	45.1	1	45.1

In general the fish which were longest at the end of second winter in the sea maintained their superior length at the end of the third sea winter.

(2) Examination of Salmon Smolts Taken in the Head Race of the Hydro-Electric Plant at Ardnacrusha, in 1938.

The inauguration of the hydro-electric scheme affected the River Shannon as a salmon river and this matter has been discussed in another part of this paper. It was considered desirable to investigate whether the alterations produced in the river had caused any material alterations in the life history of the salmon. Therefore in the beginning of 1938 arrangements were made for the collection of samples of salmon smolts from the River Shannon. Originally it was proposed to take three samples of at least 100 each, these samples to be taken :—

(*a*) at the beginning of the smolt run,
(*b*) when the run of smolts was at a maximum, and
(*c*) when the run of smolts had commenced to diminish.

Normally the smolt run begins at the end of April, reaches a maximum by the middle of May and is completed by the middle of June. Sometimes

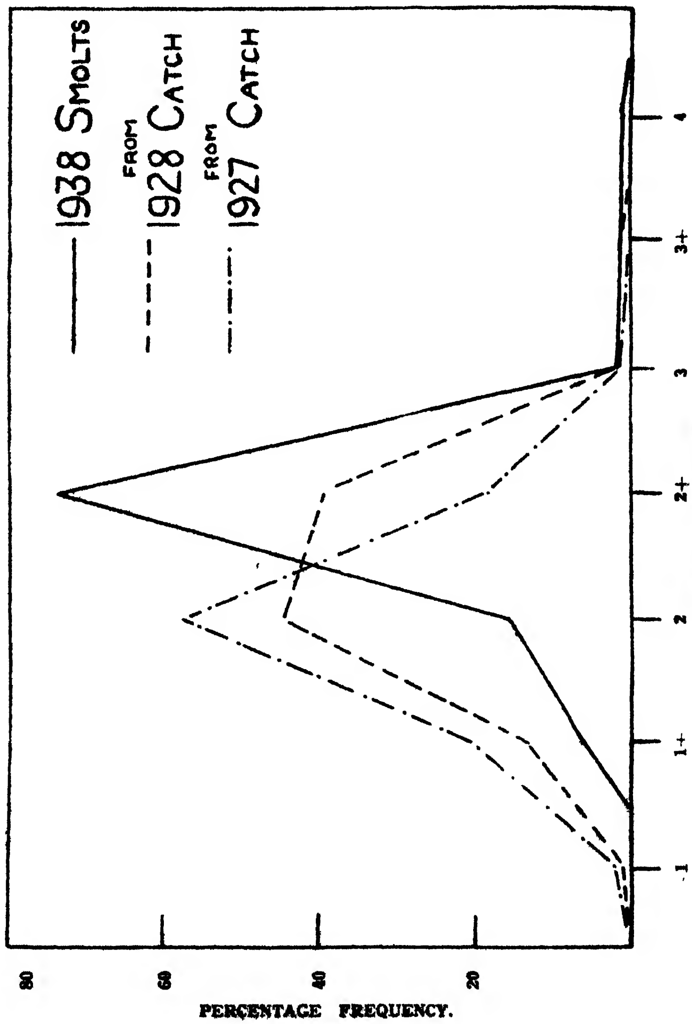


Fig. 11. Smolt Ages.

there is said to be a small migration in September. In 1938 the run of smolts was about six weeks earlier than usual in the River Shannon and only two small samples of smolts numbering 51 and 61, respectively, could be obtained. In passing, it might be interesting to note that the rise of the Mayfly in Lough Derg and other lakes on the Shannon system was also about four weeks earlier than usual. In fact many visiting anglers reached Lough Derg nearly a month late for the Mayfly (dapping) season.

I am indebted to Mr. Liam Forde, Fisheries Director of the Electricity Supply Board, for his kindness in furnishing the foregoing information.

MATERIAL.

The material consisted of 112 sets of scales and data from smolts taken at the power house at Ardnacrusha, on the 24th April and 16th May. It is not suggested that the samples were truly representative of the smolts of the whole of the River Shannon as smolts from that part of the river below Parteen dam and of the Kilmanstulla tributary were absent from the collection made at Ardnacrusha. Also Mr. Forde suggests that smolts from the different tributaries tend to keep together in the head race instead of mingling as might be expected so that the samples may represent smolts taken from one tributary or even one localised region of one tributary. This must be borne in mind in the following discussion. It might be noted, however, that the intention is to collect smolts from the River Shannon for several years in order to investigate their growth fairly completely.

AGE.

The smolts collected belong to four age classes, namely 1, 2, 3 and 4 years, It is interesting to note that the single 4 year smolt is the first of its kind to be found in this series of investigations (*i.e.* from the collection of smolts, Went, 1938 (6) and from the examination of the scales of adult fish from the catches of 1924-1928 inclusive, Southern, 1928 (5a) and Went, 1938 (6).

In the 2 and 3 year age classes there were both types A and B smolts, Went, 1938 (6) and in the 1 and 4 year age classes there were, respectively, type B and type A smolts only. The frequency of the different age classes is given below.

Age Class	Smolt Type	Frequency	
		Number	Percentage
1	B	7	6.5
2	A	17	15.9
2	B	79	73.7
3	A	2	1.9
3	B	1	1.0
4	A	1	1.0

The smolts in the present sample were considerably older on the average than those examined previously (Went, 1938 (6)). Fig. 11 illustrates graphically the age of the smolts in

(*a*) the present material,
(*b*) from examination of the 1927 catch and
(*c*) from examination of the 1928 catch.

Assuming that on the average the + growth in the type B smolts represents 2 months growth in fresh water, then the average age of the smolts in the various periods mentioned above is as follows :—

1938 smolts	2.12	years
Smolts examined previously (Went, 1938 (6)) ..	1.74	,,
From 1927 catch (Went, 1938 (6))	1.88	,,
From 1928 catch Section 1 of this paper ..	1.98	,,

PROPORTION OF THE SEXES.

The sex of all but one of the smolts was noted and 51 or 45.9 per cent. were males.

Orton, Jones and King, 1938 (4) described mature males from the Cheshire Dee. The material at my disposal showed that 8 out of 51 or 15.7 per cent. of the males had enlarged testes indicating that they had matured during the previous spawning season. Southern, 1933 (5b) also described the spawning marks on the scales of salmon parr taken from a number of rivers but such marks were not visible on the scales taken from this material.

LENGTHS.

(*a*) Mean Lengths of Parr at End of First Winter.

The following table gives the mean length in inches at the end of the first winter in the Type A and Type B smolts in the various smolt classes.

Smolt Age	Type A Smolts	Type B Smolts	All Smolts
One year	—	4.03	4.03
Two years	3.06	1.77	1.99
Three ,, ...	1.3	1.1	1.2
Four ,, ...	1.0	—	1.0

(*b*) Mean Lengths of Parr at End of Second Winter.

The following table gives the mean length in inches at the end of the second winter in the Type A and Type B smolts in the 2, 3 and 4 year smolt classes.

Smolt Age	Type A Smolts	Type B Smolts	All Smolts
Two years	5.84	5.25	5.48
Three ,, ...	4.30	2.80	3.80
Four ,, ...	2.8	—	2.8

(*c*) Growth in Fresh Water.

In the following table the two previous tables have been combined, the figures denoted thus **2.40** and $\overline{\mathbf{2.09}}$ being those calculated from the measurements of the scales of adult fish in 1927 and 1928, respectively.

Smolt Class	Growth Type A: Length in Inches at end of 1st Winter	Growth Type A: Length in Inches at end of 2nd Winter	Growth Type B: Length in Inches at end of 1st Winter	Growth Type B: Length in Inches at end of 2nd Winter	Both Types Combined: Length in Inches at end of 1st Winter	Both Types Combined: Length in Inches at end of 2nd Winter
1 year	—	—	4.03 **3.66** **3.00** —	—	4.03	—
2 years ..	3.06 **2.40** **2.09** —	— 5.84 **5.63** **5.40**	1.77 **2.02** **1.89** —	— 5.25 **5.20** **4.64** —	— 1.99	— 5.48
Mean length of all fish at end of winter prior to migration ..	5.86		5.16		5.28	

In the above table the three and four year smolt classes have been omitted as they were too few in number to give means which were significant. It will be seen quite plainly that the average lengths at the end of the winter prior to migration of the smolts taken in 1938 in each smolt class was higher than the calculated values obtained from the scales of adult fish in 1927 and 1928. In Fig. 12 the growth curves of the one year Type B and the Types A and B two year smolts are given for the 1938 smolts and those calculated from the scales of adult fish in 1927 and 1928.

(*d*) Length at Migration.

The following table gives the mean lengths in inches of the two growth types in each smolt class at the time of migration (time of capture).

Smolt Age	Mean Length at Time of Migration: Type A Smolts	Mean Length at Time of Migration: Type B Smolts
1 year	—	6.1 (7)
2 years	6.0 (17)	6.28 (79)
3 ,, ...	6.25 (2)	6.1 (1)
4 ,, ...	5.4 (1)	—

The numbers in brackets indicate the number of individuals examined in each group. As will be seen the mean length at the time of migration is fairly constant in all the groups. The mean length of all the smolts was 6.17 inches compared with 5.65 inches for the smolts previously examined

(Went, 1938 (6)) and 5.54 inches calculated from the scales of adult fish in 1928 (see previous section of this paper). The frequency distribution curves for

(*a*) Length of the smolts calculated from the 1928 adult salmon,
(*b*) Length of the smolts previously examined, and
(*c*) Length of the smolts at present under discussion

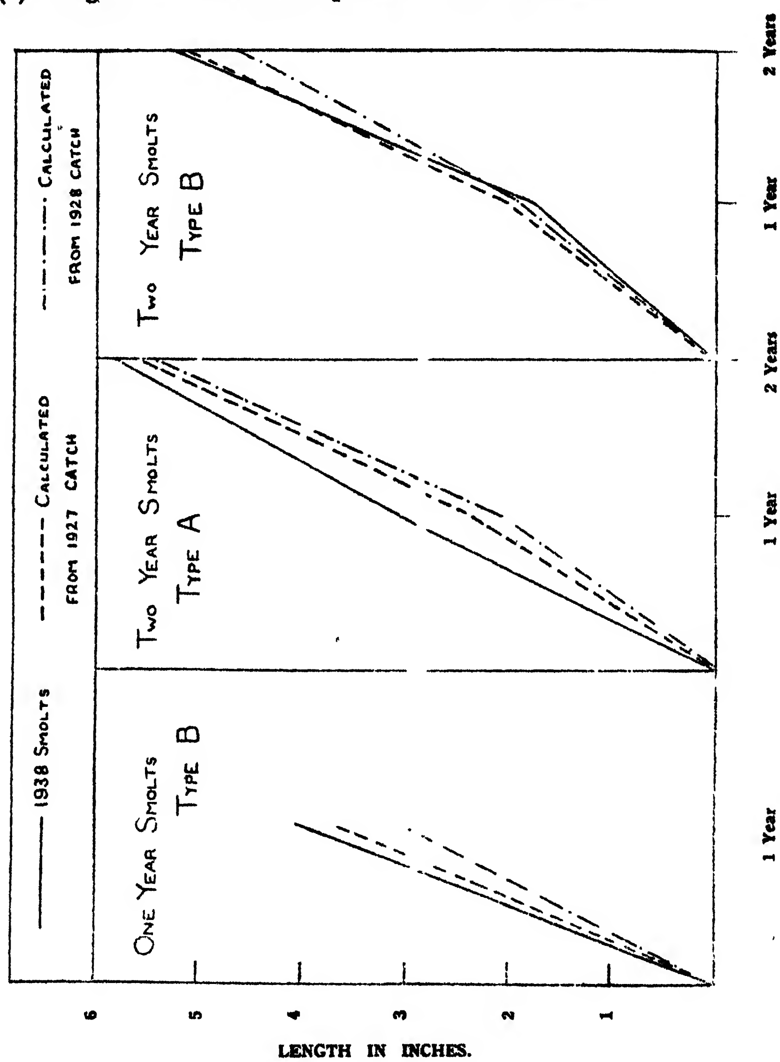


Fig. 12.

are given in Fig. 13. It will be seen clearly that there is an increase in size at migration in the 1938 smolts when compared with the smolts examined previously and with the smolts which returned to fresh water as adults in 1928.

It is impossible to say, at this stage, whether or not the increase in fresh water growth rate, and the age at the time of migration, are connected with the alterations in the river produced by the hydro-electric works.

SEX DIFFERENTIATION.

The average size of the two sexes at the time of migration did not differ markedly, being 6.06 and 6.20 inches for the females and males, respectively. The growth in the males is slightly more rapid on the average than in the females. The distribution of the age classes was very similar in the two sexes, as can be seen from the following table :—

Smolt Class	Smolt Type	Sex			
		Male		Female	
		No.	%	No.	%
1	B	4	8.3	3	5.2
2	A	7	14.6	10	17.2
2	B	36	75.0	42	72.5
3	A	—	—	2	3.4
3	B	1	2.1	—	—
4	A	—	—	1	1.7

LENGTH/GIRTH RELATIONSHIPS AND CONDITION FACTORS OF THE SMOLTS.

Girth measurements were made where possible and for each fish a length/girth ratio was calculated. The average length/girth ratio for the males (immature), males (matured) and females were 1.87, 1.90 and 1.90, respectively.

A condition factor for each fish was determined from the formula

$$\text{Condition factor} = \frac{100{,}000\,W}{L^3} \quad \begin{array}{l}\text{where } W = \text{weight in pounds}\\ \text{and } L = \text{length in inches.}\end{array}$$

and the results are given in the following table.

Sex	Condition Factor
Immature Males	36.1
Mature ,, ...	36.1
Females	36.5

It will be obvious from the above that the differences in the two sets of results, namely Length/Girth ratios and condition factors, are too small to justify any conclusions as to the relative development of the two sexes. It might be mentioned in passing that the average Length/Girth ratio for the Cheshire Dee smolts given by Orton, Jones and King, 1938 (4) is considerably higher than that determined for the River Shannon smolts. These authors, however, mention that the smolts were measured after preservation in formalin. That measurements of material preserved in formalin are unreliable for comparative purposes was amply proved recently when on

re-investigating some smolts originally examined in the fresh condition results differing as much as 15 per cent. were obtained. This is particularly noticeable in girth measurements as shrinkage after preservation in formalin is often quite severe.

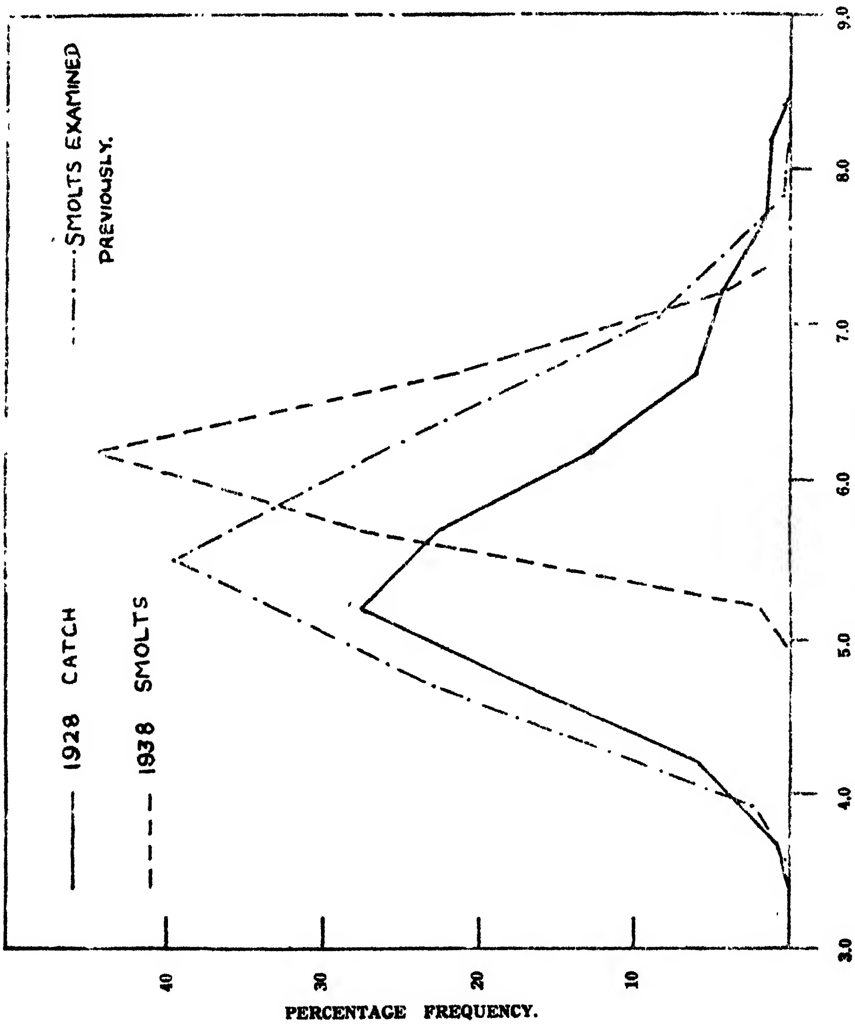


Fig. 13. Length in Inches.

SUMMARY.

(1) Analysis of the Stock of 1928.

(1) Material, consisting of sets of scales and data, was collected from the Lax Weir Fishery just above Limerick, and from the rod catches in the stretch of the river from O'Brien's Bridge to Killaloe on the River Shannon. As undue emphasis was given to some groups the figures were weighted against the record of the catches at the Lax Weir.

(2) 97.4 per cent. of the total had migrated as one and two year smolts and the precentage of one year smolts was 13.5 per cent.

(3) Grilse and small spring fish formed over 55 per cent. of the total catch in 1928. Commercially, however, the large spring fish (19.85 per cent.) are four times as important as the grilse and about 55 per cent. more important than the small spring fish. The majority of the previously spawned fish exhibit the long absence habit. The major part of the catch was made in the months April to June, inclusive. Grilse run mainly in June, and April and May were the most important months from the commercial point of view. The runs of fish in February, March and April were mainly spring fish. May is a transitional month with both spring and summer fish, whilst June and July had runs consisting almost entirely of summer fish, grilse being preponderant.

(4) Fish derived from one year smolts were superior in average weight and length to those of the two year smolt class in the grilse only.

(5) Taking the spring and summer fish separately there was a decrease in the percentage of females with increasing age.

(6) Size differentiation in the sexes varied in the different age groups. The differentiation increased with age ; and in the large spring fish the difference in average weight and length of the sexes amounted to $2\frac{3}{4}$ lbs. and $2\frac{3}{4}$ inches. In each age group the fish having maximum weights and lengths were said to be males.

(7) Spring fish on the average were in better condition than summer fish. Taking the spring fish and summer fish separately there was an increase in average condition coefficient with increasing age. The condition coefficient of Shannon salmon is higher than that of any other river which has been adequately investigated. In the small and large spring fish there is an improvement in condition with increase in length. The spring fish show a decline in condition as the season progresses.

(8) The lengths of all " maiden " or unspawned fish at different periods of life were calculated from scale measurements. The faster growing parr migrate first.

Some scales showed a large amount of growth in the spring prior to migration as a smolt. This type of growth was denoted by the term Type B smolt growth. Smolts showing little or no growth in the spring prior to migration were described as Type A smolts. Type B smolts at the end of the winter prior to migration to the sea were smaller than Type A smolts of the same smolt class. The difference between the calculated lengths was shown to be statistically significant.

It was possible to calculate the smolt size from measurements of the scales, and the average size for all smolt classes was 5.54 inches. The mean smolt size rises with increasing age of the smolts. Taking the spring and summer fish separately there was a rise in smolt size with an increase in age.

The grilse were the shortest fish at the end of the first sea winter and there was a rise in the average length at end of the first sea winter with increasing age. The small spring fish were superior in average lengths at the end of both the first and second sea winters to those of the small summer fish.

(2) Examination of Smolts from the 1938 Run.

(1) Material consisting of 112 smolts was taken at the power house, Ardnacrusha, in April and May, 1938.

(2) The smolts belonged to four smolt classes, namely one, two, three and four year smolt classes although the majority, 96.1 per cent., belonged to the one and two year smolt classes. The average age of the smolts was considerably higher than that of those examined previously and from the catch of 1927 and 1928.

(3) 45 per cent. of the smolts were males and 15.7 per cent. of these had enlarged testes indicating that they had matured the previous year. No spawning marks were visible on the scales.

(4) The growth calculations of the smolts indicated that the fastest growing smolts migrated first and that the Type A smolts were longer than the Type B smolts of the same smolt class at the end of each winter in fresh water. The mean length of the smolts at time of migration (time of capture) was 6.17 inches compared with 5.65 and 5.54 inches calculated from adult scales from catches of 1927 and 1928.

(5) Size differences in the two sexes were too small to justify any conclusion.

REFERENCES.

(1) Hutton, J. A.,—" Wye Salmon." Salmon and Trout Magazine No. 86, March, 1937.

(2) Menzies, W. J. M., (*a*) " Salmon of the River Dee " Fisheries, Scotland, Salmon Fish, 1921, I (June, 1922).

(*b*) " The Salmon," 2nd Edition, 1931.

(3) Jones, J. W., and G. M. King—" Dee Salmon Parr." Salmon and Trout Magazine, No. 95, June, 1939.

(4) Orton, J. H., Jones, J. W. and King, G. M. " The male sexual Stage in Salmon Parr (Salmo salar L. Juv.)" Proc. Roy. Soc., B.838, Vol. 125, 1938.

(5) Southern, R., (*a*) " Salmon of the River Shannon " 1924, 1925 and 1926, Proc. Irish Acad., Vol. 38. B.3, 1928.

(*b*) " Do salmon ever spawn before they go to sea ? Newly discovered evidence from Ireland." The Field, London, 10th June, 1933, page 1836.

(6) Went, A. E. J., " Salmon of the River Shannon." Proc. Irish Acad., Vol. 44 B II., [illegible].

APPENDIX.

TABLE 1.

Percentage of Each Smolt Age in Each Age Group.

Smolt Age	Age Groups							
	1+	2	2+	3	3+	4	S.Ms.	Total
1 year ..	11.9	9.2	10.8	20.60	—	14.30	22.2	13.50
2 years ..	82.2	88.9	88.6	77.50	—	85.70	77.0	83.90
3 „ ..	5.9	1.9	0.6	1.90	100	—	0.8	2.60
Total ..	100	100	100	100	100	100	100	100

TABLE 2.

Monthly Changes in Percentage of One Year Smolts.

Month	Age Group				
	1+	2	2+	3	S.Ms.
February ..	-	15.4	—	27.5	31.2
March	--	15.8	-	25.8	30.8
April	--	7.9	13.7	13.1	27.9
May	0.0	10.6	11.3	25.6	8.0
June	12.8	50.0	22.2	0.0	0.0

TABLE 3.

Monthly Sample of Fish in Different Age Groups.

Month	Age Group							
	1+	2	2+	3	3+	4	S.Ms.	Total
February	—	26	—	40	—	1	16	83
March	—	29	—	62	—	2	13	106
April	—	288	23	107	—	1	62	481
May	6	122	135	47	1	3	25	339
June	78	2	9	1	—	—	3	93
Total ..	84	467	167	257	1	7	119	1,102

TABLE 4.

Percentage of Each Age Group in Each Month's Catch.

Month	Age Group 1+	2	2+	3	3+	4	With S.Ms. Spring Fish	With S.Ms. Summer Fish	Total
February	—	26.8	—	53.8	—	0.8	18.60	—	100
March ..	—	27.2	—	58.6	—	3.0	11.2	—	100
April ..	—	59.8	2.9	22.2	—	0.4	14.7	—	100
May ..	3.7	39.1	41.6	8.6	0.20	0.50	4.36	1.94	100
June ..	77.0	6.7	12.60	0.10	—	—	—	3.60	100
July ..	97.6	0.9	1.3	—	—	—	—	0.20	100
TOTAL ..	24.73	31.02	15.18	19.85	0.05	0.71	7.38	1.08	100
							8.46		

TABLE 5.

Percentage of Total in Each Age Group in Each Month.

Month	Age Group 1+	2	2+	3	3+	4	With S.Ms.	Total
February ..	—	1.9	—	6.4	—	2.4	4.8	2.2
March ..	—	14.1	—	52.1	—	67.8	22.4	16.7
April ..	—	46.1	4.8	29.2	—	11.6	42.4	24.8
May ..	4.05	32.1	72.5	12.1	100	18.2	19.4	26.3
June ..	85.20	5.7	22.4	0.2	—	—	10.9	27.3
July ..	10.75	0.1	0.3	—	—	—	0.1	2.7
TOTAL ..	100	100	100	100	100	100	100	100

TABLE 6.

Showing Divided Migration and Return.

The following table gives the years in which the fish examined were hatched. Values given are percentages of total

Returned in 1928 as	1921	1922	1923	1924	1925	1926	Total
1+ ..	—	—	—	1.49	20.80	2.94	24.73
2 ..	—	—	0.59	27.57	2.86	—	31.02
2+ ..	—	—	0.09	13.45	1.64	—	15.18
3 ..	—	0.17	15.60	4.08	—	—	19.85
3+ ..	—	0.05	—	—	—	—	0.05
4 ..	—	0.61	0.10	—	—	—	0.71
With S.Ms. ..	0.45	4.34	3.29	0.38	—	—	8.46
Total ..	0.45	5.17	19.67	46.97	24.80	2.94	100

TABLE 7.

Frequency Distribution of Sizes in Different Age Groups.

Size in Inches	Age Group							Total
	1+	2	2+	3	3+	4	With S.Ms.	
17	1	—	—	—	—	—	—	1
18	1	—	—	—	—	—	—	1
19	3	—	—	—	—	—	—	3
20	3	—	—	—	—	—	—	3
21	17	—	—	—	—	—	—	17
22	21	—	—	—	—	—	—	21
23	14	1	—	—	—	—	—	15
24	21	2	—	—	—	—	—	23
25	3	6	2	—	—	—	2	13
26	—	23	9	—	—	—	1	33
27	—	34	12	—	—	—	—	46
28	—	49	18	—	—	—	1	68
29	—	79	13	—	—	—	—	92
30	—	62	19	—	—	—	3	84
31	—	73	23	—	—	—	10	106
32	—	71	32	1	—	—	4	108
33	—	29	21	1	—	—	9	60
34	—	18	10	4	—	—	6	38
35	—	10	2	11	—	—	12	35
36	—	4	2	25	1	—	11	43
37	—	1	3	27	—	—	16	47
38	—	—	1	30	—	—	7	38
39	—	—	—	21	—	—	7	28
40	—	—	—	20	—	—	8	28
41	—	—	—	38	—	1	7	46
42	—	—	—	38	—	1	7	46
43	—	—	—	22	—	2	4	28
44	—	—	—	10	—	1	—	11
45	—	—	—	8	—	1	2	11
46	—	—	—	—	—	—	—	—
47	—	—	—	—	—	1	—	1
48	—	—	—	—	—	—	—	—
Total ..	84	462	167	256	1	7	117	1,094

TABLE 8.

Average Weight, Length and K of Age Groups in Each Month.

a. 1 + Winters.

Years in River ..	1			2			3			Total		
Month	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K
April	—	—	—	—	—	—	—	—	—	—	—	—
May	—	—	—	5.23	24.05	1.043	—	—	—	5.23	24.05	1.043
June	5.125	22.90	1.189	4.80	22.44	1.178	4.77	22.6	1.146	4.91	22.51	1.177
Total ..	5.125	22.90	1.189	4.88	22.58	1.166	4.77	22.6	1.146	4.94	22.62	1.167

b. 2 Winters.

Years in River ..	1			2			3			Total		
Month	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K
February	13.53	31.28	1.177	13.12	30.98	1.176	13.63	31.7	1.168	13.21	31.05	1.176
March	10.41	30.10	1.046	11.96	30.52	1.150	15.25	32.1	1.280	11.91	30.53	1.143
April	11.31	29.86	1.166	12.69	30.86	1.180	13.62	30.7	1.272	12.60	30.80	1.182
May	9.68	29.01	1.099	11.56	29.76	1.166	—	—	—	11.40	29.70	1.160
June . ..	9.63	29.3	1.061	14	-	--	—	—	—	11.83	29.3	1.061
Total	10.91	29.53	1.138	12.43	30.93	1.183	13.80	31.0	1.260	12.31	30.78	1.180

c. 2 + Winters.

Years in River ..	1			2			3			Total		
Month	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K
April	12.43	30.95	1.152	14.49	32.03	1.233	—	—	—	14.13	31.84	1.218
May	10.92	29.93	1.116	13.63	31.68	1.210	—	—	—	13.38	31.41	1.201
June	7.56	27.00	1.065	11.35	29.95	1.171	12.13	30.3	1.211	10.59	29.33	1.152
Total ..	10.90	29.80	1.117	13.65	31.66	1.211	12.13	30.3	1.211	13.34	31.45	1.201

d. 3 Winters.

Years in River ..	1			2			3			TOTAL		
Month	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K
February	30.58	40.83	1.237	28.64	39.64	1.193	27.19	39.5	1.284	29.11	39.96	1.241
March	27.86	39.35	1.243	31.75	40.70	1.310	32.13	40.6	1.336	30.66	40.34	1.291
April	25.59	38.56	1.229	29.88	40.08	1.267	20.25	36.3	1.176	29.24	39.85	1.260
May	24.54	37.76	1.261	29.62	40.33	1.195	29.63	41.3	1.167	28.38	39.72	1.211
June	—	—	—	23.50	38.50	1.146	—	—	—	23.50	38.50	1.146
TOTAL ..	27.03	39.08	1.238	30.06	40.19	1.247	27.28	39.44	1.245	29.78	40.01	1.245

e. 3+ Winters.

Years in River ..	1			2			3			TOTAL		
Month	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K
May	—	—	—	—	—	—	21.5	36.3	1.251	21.5	36.3	1.251
June	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL ..	—	—	—	—	—	—	—	—	—	21.5	36.3	1.251

f. 4 Winters.

Years in River ..	1			2			3			TOTAL		
Month	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K
February	—	—	—	39.25	41.7	1.503	—	—	—	39.25	41.7	1.503
March	56.63	47.8	1.572	44.0	44.3	1.572	—	—	—	50.32	46.55	1.572
April	—	—	—	40.875	42.0	1.550	—	—	—	40.875	42.00	1.550
May	—	—	—	37.25	44.10	1.208	—	—	—	37.25	44.10	1.208
June	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL ..	56.63	47.8	1.572	39.31	43.37	1.375	—	—	—	41.80	44.20	1.403

With S.M.'s.

Years in River ..	1			2			3			Total		
Month	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K	Weight lbs.	Length ins.	K
February	26.30	39.1	1.214	27.74	38.79	1.260	—	—	—	27.26	38.89	1.245
March	25.16	39.58	1.197	21.74	36.37	1.199	—	—	—	22.79	37.35	1.198
April	20.93	36.16	1.204	23.13	37.00	1.247	19.5	34.2	1.315	22.53	36.79	1.235
May	28.13	39.3	1.280	21.19	35.83	1.230	—	—	—	22.18	36.40	1.228
June	—	—	—	7.0	25.6	1.14	—	—	—	7.0	25.6	1.14
Total ..	23.86	38.79	1.211	22.52	35.52	1.249	19.5	34.2	1.315	22.89	37.07	1.239

TABLE 9.

Percentage of Females in Each Age Group in Each Month.

Age Group	1+			2			2+			3			With S.Ms.			Total
Smolt Age	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
February	—	—	—	75.0	76.2	100	—	—	—	36.4	50.0	50.0	60.0	72.8	—	59.6
March	—	—	—	100	70.8	100	—	—	—	60.0	43.6	—	75.0	55.6	—	56.2
April	—	—	—	69.6	63.8	57.2	75.0	57.8	—	50.0	40.4	100	53.0	55.7	—	57.8
May	—	100	—	92.3	73.4	—	81.7	56.2	—	45.4	16.1	100*	50.0	34.8	—	60.0
June	80.0	69.8	100	—	100	—	50.0	16.6	100	—	—	—	—	—	0	66.3
Total	80.0	72.5	100	79.1	67.6	66.6	76.5	54.7	100	57.5	38.4	60.0	57.2	50.6	—	72.8
Total for each Age Group		74.7			68.6			57.3			42.2			52.2		63.41

*100 for 3.3+

TABLE 10.

Average Weights and Lengths in the Different Age Groups in the Two Sexes.

	Average Length						Average Weight						
Sex	Female		Male		Female	Male	Female		Male		Female	Male	
Smolt Age ..	1	2	1	2	All Fish	All Fish	1	2	1	2	All Fish	All Fish	
Age Group :—													
1+ Winter ..	—	—	—	—	22.28	23.40	—	—	—	—	4.66	5.53	Male +
2 " ..	29.50	30.04	30.85	31.72	30.01	31.69	10.64	11.44	12.11	14.26	11.42	14.16	Male +
2+ " ..	—	—	—	—	30.0	33.38	—	—	—	—	11.69	15.37	Male +
3 " ..	38.33	38.40	39.11	41.39	38.39	41.13	25.72	26.10	26.28	31.98	28.35	31.16	Male +

11*a*.

Mean Degree of Erosion.

Age Group	1+		2		2+		3	
Smolt Age	1	2	1	2	1	2	1	2
February ..	—	—	0	0	—	—	0	0
March ..	—	—	0	0	—	—	0.13	0.90
April ..	—	—	0	0.004	0	0	0.71	0.36
May ..	—	0	0	0.13	0	0.024	2.42	2.15
June ..	0	0	—	3.0	0	0.5	—	6.0

11*b*.

Percentage of Fish with Eroded Scales.

Age Group	1+		2		2+		3	
Smolt Age	1	2	1	2	1	2	1	2
February ..	—	—	0	0	—	—	0	0
March ..	—	—	0	0	—	—	12.5	9.0
April ..	—	—	0	0.4	0	0	50.0	24.5
May ..	—	0	0	9.1	0	0.8	92.0	76.0
June ..	0	0	—	100	0	16.7	—	100.0

(Read to meeting of the Royal Irish Academy on 26th February, 1940).

WHEAT RIPENING AS INFLUENCED BY TIME OF SOWING AND OTHER FACTORS

By

B. Crombie, M.Sc., B.Agr.Sc., Plant Breeding Department, University College, Dublin.

Ireland is favoured by a remarkably long wheat-sowing season. Good yields can be obtained from sowings made throughout the seven-month period from the beginning of October to the end of April—provided that a suitable variety appropriate to the time of sowing is used. Varieties well adapted to sowing in the different months of this period are available.

Wheat varieties are usually roughly grouped into two classes :—

1. *Winter Varieties.*—Those that should be sown in late autumn or winter to ensure ripening in reasonable time, say August.

2. *Spring Varieties.*—Those that need not be sown till March or April and will still ripen in August or early September according to season.

On closer examination however it is found that neither of these is a homogeneous group and that varieties range in an almost continuous series from extreme winter types like Steel to extreme spring types like Marquis and Aurora.

Spring wheats have been derived from four distinct types of habitat :—

1. Siberia—where the winter is too severe for winter varieties.

2. Continental regions of the sub-tropics.

3. Mountainous regions.

4. Countries of periodic rains—India and China.

In each of these regions the growing season is very short. The varieties evolved there have acquired a capacity for very rapid development. They assume an upright growth habit immediately after emergence and proceed directly to the reproductive phase.

Winter wheats on the other hand must have a long growing season such as is found in Western Europe and the Southern United States where winter temperatures rarely drop sufficiently low to kill hardy winter varieties. These varieties invariably adopt in their early stages a prostrate habit of growth so that they are easily covered by snow which affords them protection from the biting winds.

Extreme squatness in the early stages does not always imply very slow development later. Yeoman II is a winter variety with a rapid rate of development; yet when young it is more squat than very late varieties such as Steel and Pajbjerg. Apart from growth habit winter wheats are much more winter-hardy than spring varieties. This is due to their physiological nature. As compared with tender spring varieties, hardy winter types always have a higher carbohydrate/nitrogen ratio and a higher dry matter content, mainly in the form of sugar (2) (33) (34). The latter difference becomes more pronounced in cold weather. When growing under mild conditions they may, like spring varieties, have a water content of 80%. But when subjected to cold they lose this water much more slowly than do spring varieties (29). In a period of prolonged frost winter varieties can withstand a greater degree of dehydration without wilting than can the spring types. Furthermore they respire very slowly at low temperature and so conserve their sugar. A gradual decrease of temperature has a hardening effect on all wheats as it reduces their water content, thereby enabling them to endure lower temperatures later on.

Martin (33) found that any winter variety without hardening will endure —5°C. but not—10°C. for 24 hours. After hardening some winter varieties will survive —25°C. without snow protection. Spring varieties like Marquis cannot be relied upon to endure a temperature lower than —5°C. for 24 hours. But this temperature is lower than we are likely to experience in this country for a continuous period of 24 hours at any time.

Temperature conditions here need hardly ever cause us serious concern. We can even sow spring varieties in winter if we wish. (The converse is what we frequently do). Accordingly we are mainly interested in discovering the best sowing date for each variety of wheat, that is, the sowing time from which we can hope to obtain maximum yields in an average season. In the event of our being prevented by unfavourable weather from sowing at the best time, we are anxious to determine the time-limit up to which we can sow each variety with a fair assurance of success.

TIME OF SOWING.

Numerous experiments have been carried out on the time of ripening of wheat as influenced by the time of sowing.

In England Percival (35) studying the problem from 1912 to 1916 found that any variety earing later than 10th July had not time to ripen at Reading. He found that winter varieties sown up to the end of February ripened before mid-September. Sown in March, they eared in August but failed to ripen. Sown in April, they remained in the grass corn stage until the following year when they eared about the normal time.

The spring variety Red Fife sown on 5th April ripened by mid-September. All later sowings of this variety up to 5th July eared in Autumn but did not ripen. On the other hand, as showing how different years may produce very different results, it is on record that a crop of Red Fife sown in England on the 9th May, 1917, yielded 43 bushels per acre on 8th September, 1917 (6).

In many states in America, where winter-killing seriously affects wheat sown later than 1st October and where Hessian Fly (Phytophaga destructor) frequently injures crops sown early in September, it has been found best to confine sowings to the middle of September. (10) (11) (13) (30) (37).

At the Arlington Experiment Station where winters are mild and wet Leighty and Taylor (31) found that the yield of winter wheat increased with lateness of sowing up to 1st November. Subsequent sowings gave gradually diminishing yields. Bayles and Martin (1) in Oregon, found that when winters were mild, as they occasionally are in that state, winter wheat could be sown right through the winter, and up to mid-February or even 1st March. They observed that a date was reached in March when sowings of winter wheat failed to ear that season. This critical date varied slightly from year to year but always lay within the narrow limits of 20 days.

The same investigators found that true spring wheats have no critical sowing date. Provided they are not prevented by cold weather they always proceed directly to the earing stage irrespective of time of sowing. Sunset and Quality, two true spring varieties, sown on 6th July, eared on 10th August and produced some grain in September.

Even in parts of Australia there is a critical sowing time for winter wheats. Forster (12) found that if they were sown later than September (corresponding to our April) they failed to ear in the same season.

Hume and Evans (14), working in the North American spring wheat belt, found the middle of March to be the best time to sow spring wheats in S. Dakota provided the soil was in proper condition. They noted that "when winter lingers in the lap of spring," sowing is best deferred until about 1st April and accordingly they emphasised the importance of "seasonably early sowing."

It may be mentioned that throughout nearly all Canada and a considerable

zone of the Northern United States the sowing of winter wheat is precluded by very severe winters, while the sowing of spring wheat is often delayed by the frozen or semi-thawed condition of the soil in the spring.

Further south in the winter wheat belt of the U.S.A., winters vary in severity but are always such as to cause a certain amount of winter-killing. In this region, even when the hardiest varieties, Minturki, Kanred and Turkey, are sown, the acreage annually abandoned on account of winter-killing ranges from 1% to 30% and averages 10% (8) (38).

All cerealists are agreed that where winter wheats can be grown they are to be preferred to spring wheats as they are consistently heavier yielders (5) (10) (11) (13) (35) (36). Their greater yielding power is inherent in their genetic constitution and is due mainly to their having a longer growing season (5). In addition, they escape the worst ravages of yellow rust (*P. glumarum*) wherever it exists and they are able to take greater advantage of the stored soil moisture in the event of a subnormal summer rainfall. This latter property is due to their having a better developed root system at the beginning of summer. Even in our humid climate, this characteristic of winter wheat is often of prime importance, as has been shown by the experience gained during the recent dry summers of 1933, 1934, 1935, 1937 and 1939, and has been frequently borne out by the crop reports of the Department of Agriculture published in this Journal during the past 30 years (15) (16) (17) (18) (20) (21) (22).

In a normal or even in a rather wet season winter wheat outyields spring wheat, while in an abnormally dry year it surpasses all other cereals in drought tolerance and consequently in potential yield. Therefore, winter varieties are sown wherever possible. Furthermore it is to the advantage of the farmer from the point of view of labour distribution if he can sow portion of his cereal acreage in autumn or winter.

IRISH EXPERIMENTS.

While in Continental regions the winter-hardiness of the variety is the deciding factor, our mild insular climate enables all varieties to survive the winter. But as spring varieties are usually inferior in yield, we reserve them for sowing in spring when it has become too late to sow winter varieties.

The Department of Agriculture since its inception in 1900 has taken a keen interest in the furtherance of wheat cultivation and a comprehensive set of variety and manurial trials on ordinary farms all over the country is conducted annually under the supervision of Instructors employed by the County Committees of Agriculture. These experiments were planned with the primary

object of demonstrating to farmers the best methods of manuring and cultivation and the most suitable varieties to sow.

As late sowing is not always successful, autumn or early winter sowing was invariably recommended with the qualification that, if necessary, certain winter varieties could be sown up to mid-February (19) (21) (26). Occasionally weather conditions and local farming methods led to wide departures from this recommendation. These very divergences afford us an excellent opportunity to glean useful information as to how late a variety of winter wheat can be sown and give a successful crop.

It is of interest to select some of the latest of these sowings and to compare their yields with those obtained by sowing at times generally regarded as being most suitable.

In Tables I to V are given the location, dates of sowing and yields obtained in the case of the two latest sowings in each of five seasons, compared with the average yields from the same varieties sown on various dates, but mainly from October to January (inclusive) in the same seasons.

Yields Obtained in Ireland From Spring-Sown Winter Wheats, Compared With the Yields From the Same Varieties Sown in Autumn and Winter :--

TABLE I (21).

Variety	Yields per Statute Acre					
	Louth		Roscommon		Average of 18 Counties	
	Date of Sowing 13th–19th Feb., 1918		Date of Sowing 9th March, 1918		Date of Sowing Nov. and Dec., 1917	
	cwts.	qrs.	cwts.	qrs.	cwts.	qrs.
Benefactor ..	34	1	23	2	24	3
Queen Wilhelmina	25	0	21	0	25	1
Squarehead Master	26	3	22	3	23	0
White Stand Up ..	22	2	21	2	23	3

TABLE II (23)

Variety	Yields per Statute Acre					
	Offaly		Carlow		Average of 259 Centres	
	Date of Sowing 7th March, 1927		Date of Sowing 19th Feb., 1927		Date of Sowing Oct., 1926 to Feb., 1927	
	cwts.	qrs.	cwts.	qrs.	cwts.	qrs.
Yeoman II ..	30	0	20	0	23	3
Harvested ..	19th Sept., 1927		8th Sept., 1927		—	

TABLE III (24).

Variety	Yields per Statute Acre					
	Carlow		Sligo		Average of 38 Centres	
	Date of Sowing 26th Feb., 1929		Date of Sowing 19th Feb., 1929		Date of Sowing Nov., 1928–Feb., 1929	
	cwts.	qrs.	cwts.	qrs.	cwts.	qrs.
Queen Wilhelmina	30	3	31	0	25	2
Red Stettin 13 ..	22	3	29	0	21	2
Coney Island (Long Straw) ..	17	3	23	0	19	1
Coney Island (Short Straw) ..	21	1	27	0	22	2
Yeoman II ..	23	3	28	3	22	3

TABLE IV (24).

Variety	Yields per Statute Acre					
	Dublin		Limerick		Average of 25 Centres	
	Date of Sowing 28th March, 1930		Date of Sowing 26th March, 1930		Date of Sowing Sept. 1929/Mar., 1930	
	cwts.	qrs.	cwts.	qrs.	cwts.	qrs.
Yeoman II ..	11	0	20	0	20	3
Queen Wilhelmina	18	2	20	0	24	2
Red Stettin 13 ..	16	2	20	0	19	3
Coney Island (Short Straw) ..	12	1	18	0	21	0
Ironmaster ..	12	3	15	0	22	3

TABLE V (27).

Variety	Yields per Statute Acre					
	Kerry		Roscommon		Average of 61 Centres	
	Date of Sowing 5th Feb., 1935		Date of Sowing 4th March, 1935		Date of Sowing Oct., 1934–Mar., 1935	
	cwts.	qrs.	cwts.	qrs.	cwts.	qrs.
Queen Wilhelmina	35	2	24	0	24	3
Yeoman II ..	34	0	23	2	22	3
Ironmaster ..	33	1	22	2	24	0
Steel ..	38	1	--		26	0

It is not contended that definite conclusions can be drawn from the few comparisons embodied in the foregoing Tables because the critical sowing date for each variety varies from year to year, as will be seen later. They do show, however, that excellent yields have been obtained from many ordinary winter varieties grown in Ireland, when sown up to the end of February (Table III).

Sown up to the end of March in 1930, they ripened but yielded below the average. March sowings are attended with grave risk. At best they are followed by a diminished yield (Table IV) and usually a poor grain quality, while occasionally they fail completely.

In the Field experiments conducted by County Committees of Agriculture in the season 1935-1936, the three winter varieties Steel, Pajbjerg and Queen Wilhelmina were sown at 68 centres on dates ranging from 5th November, 1935, to 28th February, 1936 (28). Actually, half of these plots were sown in February and an analysis of the results reveals the fact that the 34 plots sown with Pajbjerg and with Queen Wilhelmina in February yielded on an average 22 cwts. and 21 cwts. per statute acre respectively which were exactly the same as the average yields obtained from these varieties when sown in winter. The February sowings of Steel yielded on an average 20 cwts. per statute acre, or a decrease of 3 qrs. as compared with the average yield from the winter sowings of Steel.

Some years ago the small area of wheat cultivated in this country was usually placed in the rotation after potatoes and mangels and sometimes after swedes. This practice enabled the farmer to clean the land and, while it was still in good condition, to prepare it quickly for winter wheat which was sown as a rule in autumn or early winter.

In recent years tillage farming methods have markedly altered, consequent upon the extension of sugar beet cultivation coupled with the rapid expansion of wheat growing. A large area of wheat is now sown after the removal of a crop of sugar beet, an operation that is not normally completed before mid-winter. At the same time new high-yielding varieties of winter wheat, like Steel and Pajbjerg, well adapted to high farming but somewhat exacting as to sowing time, have been introduced.

The position now is that our farming methods, together with the hampering effects of wet winters, make it quite impossible for us, no matter how desirable it may be, to get all our winter wheat sown before Christmas. It has become imperative then to solve the problem as to how late each variety of winter wheat could be sown in winter and spring, and thereafter to discover how late could each spring variety be sown.

Consequently, during the five seasons 1934-1935, 1935-1936, 1936-1937, 1937-1938, and 1938-1939 the writer conducted a series of time-of-sowing experiments at Glasnevin.

MATERIALS AND METHODS.

In each of the above seasons the more important winter and spring varieties were sown at intervals from early winter right through to the following summer. In all, ten winter and nine spring varieties were tested in one or more of those seasons. Table VI gives the varieties sown, and Table VII the dates of sowing in the four seasons.

TABLE VI.

Wheat Varieties in the Time-of-Sowing Experiments.

1934–1935	1935–1936	1936–1937	1937–1938	1938–1939
Queen Wilhelmina	Steel	Steel	Steel	Pajbjerg
Million	Pajbjerg	Pajbjerg	Pajbjerg	Juliana
Ironmaster	Queen Wilhelmina	Juliana	Juliana	Queen Wilhelmina
Yeoman II	Squarehead Master	Queen Wilhelmina	Queen Wilhelmina	Holdfast
Red Fife	Ironmaster	Squarehead Master	Yeoman II	Desprez 80
Marquis	Yeoman II	Ironmaster	Red Marvel	Red Marvel
—	Mansholts Van Hoek	—	April Red	Atle
	Red Marvel	Yeoman II.	Diamant	April Red
—	Red Fife	Mansholt's Van Hoek	Fylgia	Fylgia
	April Red	Red Marvel	Aurora	Aurora
—	Diamant	April Red	—	—
·	Marquis	—	—	—

TABLE VII.

Dates of Sowing.

1934–1935	1935–1936	1936–1937	1937–1938	1938–1939
1. 16th Jan., 1935	1. 3rd Dec., 1935	1. 20th Nov., '36	1. 26th Nov., '37	1. 1st Feb., 1939
2. 23rd ,,	2. 11th ,,	2. 4th Dec.	2. 20th Dec.	2. 8th ,,
3. 30th ,,	3. 18th ,,	3. 18th ,,	3. 18th Jan., 1938	3. 15th ,,
4. 6th Feb.	4. 26th ,,	4. 8th Jan., 1937	4. 4th Feb.	4. 22nd ,,
5. 13th ,,	5. 2nd Jan., 1936	5. 28th ,,	5. 11th ,,	5. 1st March
6. 21st ,,	6. 9th ,,	6. 17th Feb.	6. 18th ,,	6. 8th ,,
7. 4th March	7. 16th ,,	7. 10th March	7. 25th ,,	7. 15th ,,
8. 11th ,,	8. 27th ,,	8. 22nd ,,	8. 4th March	8. 22nd ,,
9. 19th ,,	9. 3rd Feb.	9. 31st ,,	9. 11th ,,	9. 29th ,,
10. 25th ,,	10. 10th ,,	10. 7th April	10. 18th ,,	10. 5th April
11. 1st April	11. 20th ,,	11. 14th ,,	11. 25th ,,	11. 12th ,,
12. 8th ,,	12. 27th ,,	12. 21st ,,	12. 1st April	12. 19th ,,
13. 15th ,,	13. 10th March	13. 28th ,,	13. 8th ,,	13. 26th ,,
14. 22nd ,,	14. 19th ,,	14. 5th May	14. 15th ,,	14. 3rd May
15. 29th ,,	15. 26th ,,	15. 12th ,,	15. 22nd ,,	15. 10th ,,
16. 6th May	16. 2nd April	16. 19th ,,	16. 29th ,,	16. 17th ,,
17. 13th ,,	17. 9th ,,	17. 26th ,,	17. 6th May	—
18. 21st ,,	18. 16th ,,	18. 2nd June	18. 13th ,,	—
—	19. 23rd ,,	19. 9th ,,	19. 20th ,,	—
—	20. 30th ,,	20. 16th ,,	20. 27th ,,	—
—	21. 7th May	21. 23rd ,,	21. 3rd June	—
—	22. 13th ,,	22. 1st July	22. 10th ,,	—
—	23. 20th ,,	23. 8th ,,	23. 17th ,,	—
—	24. 27th ,,	—	24. 24th ,,	—
—	25. 4th June	—	25. 1st July	—
—	26. 10th ,,	—	26. 8th ,,	—

In 1934-1935 the intention was to make weekly sowings from 16th January to the end of May, while in 1935-1936 the weekly sowings were planned to run from 3rd December to the middle of June, as the spring varieties in the previous year ripened when sown on 21st May. The spring varieties Red Fife, April Red, Diamant and Marquis gave some ripe grain in 1936 even in the latest sowing made that year, namely on 10th June, 1936.

Accordingly the sowings in the two subsequent seasons were continued into July.

In the 1936-1937 season when sowings were made from 20th November to 8th July it was intended to make fortnightly sowings throughout the winter, followed by weekly sowings in spring and summer. In 1937-1938 sowings ran from 26th November to 8th July. In this season it was deemed sufficient to make one sowing in each of the winter months to be followed by the usual weekly sowings in spring and summer. During 1938-1939, the fifth season of the experiment which had now assumed the nature of a demonstration; weekly sowings were made from 1st February to 17th May.

The prearranged timing of the sowings was adhered to in each of the seasons as closely as weather permitted. On a few occasions the sowing date had to be slightly postponed, due to the ground being frozen hard, snow covered or extremely wet.

Frequently sowings were made when the soil was frozen to a depth of an inch or two and again when it was very wet. Still the resulting crops did not seem to suffer any ill effects, provided the ground received a spring scuffling to prevent crust formation.

Source of Seed.—The seed which was of good quality was in every case derived from reliable stocks and true to variety. It was kept in paper bags until required for sowing.

Seed Dressing and Germination.—Before sowing began each season the seed was treated with a mercurial powder dressing for the prevention of Bunt (*T. tritici*). Samples were then tested for germination which was found to be satisfactory, ranging from 95% to 100%. Simultaneously, control or untreated samples drawn from the same stocks were tested for germination and found to germinate on the average 5% less than the treated grain.

Tests made at the end of each sowing season showed an average germination of 91%, while control samples from the same stocks similarly stored had a slightly lower germination figure.

The higher germinating power of the treated seed may be ascribed to the action of the fungicide in suppressing fungi which would have otherwise depressed germination.

Sowing.—Sowing was done by hand about 2 inches deep in lines 6 inches apart, 4 lines being allotted to each variety. The length of these lines was varied slightly from year to year but averaged 16 feet long—the width of the experimental ground.

During the first three seasons the order of the sowing of the varieties was randomised but the winter varieties were kept in one group and the spring varieties in another, as spring varieties would interfere with winter varieties by overshadowing in the early stages if indiscriminately arranged. In the third season, 1936-1937, in addition to randomisation, the sowings were duplicated. No differences attributable to position of plot or to position within plot could be detected. Both these expedients were abandoned in the fourth season 1937-1938.

In the latter season the varieties were arranged within the plots in the order of the occurrence of their critical sowing dates, a procedure rendered possible by the experience gained during the previous seasons. The slowest developing winter variety, Steel, was sown on one side of each plot, while the other varieties formed a nicely graded series up to Aurora, the most rapidly developing spring variety under test, which occupied the other side of each plot.

In 1937-1938 each variety was allotted 5 lines spaced 8 inches apart. The experimental ground was 160 yards long and 11 yards wide and, as the lines were made to run lengthwise, each variety became a narrow strip (40 inches wide) extending the entire length of the experimental ground, save where broken by the divisions between plots.

The effect of this arrangement was to demonstrate throughout the growing season in a very clear-cut, in fact graphical, fashion the developmental differences due to variety and sowing time at any particular date. Furthermore it proved the above statement that varieties could be placed in serial order with respect to rate of development, as the varieties in this year's trial justified their position in the series at all stages. This goes to show that while the critical sowing dates for a number of varieties may fluctuate from year to year they always maintain the same order.

This serial arrangement of varieties was again adopted in 1938-1939 and again it was found that all varieties had been placed correctly in the series with the exception of the new variety Desprez 80.

Observations made.—From the times of sowing to ripening in each season the varieties in all sowings were kept under almost daily observation. Records were made of the dates on which the following stages occurred :—

Emergence overground.
Exsertion of first ears.
Fully-eared condition.
Ripening.

The average height of the plants, measured to the ligule of the top leaf, was taken when the first ears appeared. The final height, or average maximum height to the top of the ears, was taken about 10 days after the completion of flowering. In addition the health and vigour of each variety were noted at the different stages.

The 19 varieties experimented with in the course of the four seasons have been roughly divided into seven groups according to their rate of development: —

1. Very slow winter varieties ..	*Steel.
2. Slow winter varieties	*Pajbjerg.
3. Fairly rapid winter varieties ..	Juliana. *Queen Wilhelmina. Million. Squarehead Master Ironmaster
4. Rapid winter varieties	*Yeoman II. Holdfast. Desprez 80.
5. Slow spring varieties	Mansholt's Van Hoek. *Red Marvel.
6. Rapid spring varieties	Atle. Red Fife. *April Red.
7. Very rapid spring varieties ..	*Diamant. Marquis. Fylgia. Aurora.

* Variety selected to represent the group in Table XIII. (See page 346).

As the varieties within each of these groups behaved in a fairly uniform manner at all times, it was considered sufficient to present here detailed data for the best known variety only from each group.

In Table XIII will be found a complete list of the dates of occurrence of the four stages previously mentioned in the case of each of the seven representative varieties during the seasons in which they were included in the experiment. The Table gives particulars for all sowings of each variety in each season up to the first sowing which failed in the most favourable season.

Fairly closely coinciding sowing dates for the different seasons are arranged on the same line in the Table, so that the effect of the season on the development of the crop may be seen at a glance.

Weather Observations.—With a view to studying the influence of weather conditions on the development and ripening of wheat, it was decided to have daily records of temperature, rainfall and sunshine, throughout the duration of the experiment. Consequently the maximum and minimum temperatures of air and soil were taken daily. For registering maximum and minimum air temperatures a thermometer was fixed 30 inches above ground and shaded from direct sunshine. A similar thermometer was placed in a recess in the soil, immediately beneath a movable zinc tray which held a 2 inch layer of soil.

Daily records of rainfall and sunshine for the period have been obtained from the meteorological station of the Botanic Gardens, Glasnevin, only one mile distant. Table XVI gives the summarised weather data for the five seasons. The extremes and means of the maximum and minimum air temperature readings for each month are given. The extremes of the maximum readings are the highest temperatures recorded on the coldest and on the warmest days in the month respectively, while the extremes of the minimum readings are the lowest temperatures recorded during the coldest and the warmest nights in the month. Furthermore the number of nights on which the temperature fell to 40°F. or lower and the number on which freezing occurred is shown separately for each month. The rainfall is given in inches and the sunshine in hours per month.

Soil temperatures seldom varied much from air temperatures and as their inclusion would mean a doubling of the temperature lists they have been omitted. It may be mentioned that they always tended to lag behind air temperatures by a few degrees and never changed so abruptly.

From the climatic data presented, a reasonably true impression of the weather for each month can be formed and conclusions may be drawn as to its effect on the wheat, especially when several seasons are compared.

Fortunately the five seasons in which the experiments were conducted were of such contrasting types as to afford ample scope for correlating weather influence with rate of wheat development.

Soil and Fertilizers.—The plots were sown each year on a heavy clay loam under open field conditions. The soil was in a high state of fertility having in each case received farm-yard manure the previous year. Artificial fertilizers were therefore not necessary for the production of a good crop of wheat. However, to test their possible effect on ripening they were introduced into the experiment in the seasons 1935-1936 and 1936-1937.

Review of Experiment.

Germination.—Although the soil was often very wet and occasionally frozen at sowing time germination and brairding were good in all sowings. Invariably both spring and winter varieties appeared over ground on the same day.

The time taken to emerge, though fluctuating a good deal, tended to diminish with seasonal advance. It ranged from 26 to 7 days in 1934-1935, from 45 to 7 days in 1935-1936, from 40 to 6 days in 1936-1937, from 37 to 6 days in 1937-1938 and from 23 to 7 days in 1938-1939.

This seasonal diminution of the period between sowing and emerging did not proceed steadily. It changed in sympathy with the weather, its duration being as a rule inversely proportional to the temperature.

Winter-Hardiness.—None of the varieties suffered any winter-killing as the climatic conditions were not sufficiently severe but the effect of the weather of January, 1936, on the sowings then coming up was very interesting. The first sowing of the 1935-1936 series emerged on 11th January and immediately encountered one of the hardest and prolonged frosts of recent years. The ground was frozen continuously from 11th January to 25th January and covered by a heavy fall of snow from 20th to 25th January. Nevertheless none of the wheat, not even the tender spring varieties was damaged. In fact the plants grew about an inch under the snow. The second sowing began to come up in frozen ground on 18th January and completed its emergence under the snow. During this period the third, fourth, fifth and sixth sowings had all germinated and grown appreciably. This shows that wheat can germinate and grow, though slowly, under frozen ground and that it can emerge through a frozen surface and grow considerably under snow. It is of further interest in indicating that the varieties in general cultivation, with or without snow covering, are rather unlikely to be winter-killed in any period of cold liable to be experienced here.

Early Growth.—Growth in the vegetative stage was satisfactory and vigorous in every instance, irrespective of time of sowing, but subsequent development and the initiation of reproduction was conditioned by the time of sowing, the nature of the season and the variety.

Critical Sowing Dates.—Rapidly-developing spring varieties, such as April Red and Diamant, will proceed directly to the earing stage, no matter when sown, and will then ripen if weather conditions permit. Sown as late as the end of May or even the beginning of June they have ripened in the same season. (Table XIII).

Red Marvel behaved in a similar manner, earing in all sowings made up to the end of June. In 1936, 1937 and 1939 it ripened in the same season when sown in early May, but in 1938 it failed to ripen any grain when sown after 22nd April. In the case of the winter varieties, *e.g.*, Pajbjerg and Queen Wilhelmina, a critical sowing date occurs, usually in April, and winter varieties sown after this date will not ear in the current season, no matter how favourable the weather may be, but remain prostrate until the following year, when they elongate, ear, and ripen only slightly earlier than normal.

The existence of a critical sowing date for earing in the case of winter wheats constitutes the real difference between these and spring varieties. While successive sowings of such varieties ear fully or partially when sown as late as the end of April, the latest sowing date to give satisfactory ripening occurs much earlier. The time of this critical sowing date for ripening is determined partly by the degree of winterness of the variety, but largely by the temperature of late March and April.

As a rule this critical sowing date for ripening in winter varieties lies between 10th February and 10th March.

The critical sowing dates for earing and for ripening are separated by 40 to 60 days, depending upon the variety and the season.

Consecutive sowings of a variety made during this period, show a gradual decline from the condition in which earing is late in starting and slow in finishing, to the stage in which no ears are produced and the plants remain prostrate until the following year.

Plants that have begun to ear sporadically in August and September continue their ear exsertion right into winter and, despite the usual cold weather of November, flowering, fertilization, and grain formation proceed until all these tender shoots are destroyed by severe frost, which however leaves the lower vegetative leaves and the squat plants unscathed.

Wheat Behaving as a Biennial.

All the winter varieties in the 1934-1935 sowings from 25th March to 21st May, inclusive, were left undisturbed during the following winter. Some of the plants that had completed earing before winter died off, evidently from

exhaustion. But in all varieties in which earing had been either incomplete or had not begun, the plants survived the winter and retained a remarkably green healthy colour throughout. In February they began fresh growth and rapidly increased in height. They were 20 inches high in April, and began to ear on 6th June, 18 days earlier than the winter varieties in the 1935-1936 crop. They ripened 10 days earlier than the latter crop. The abortive earing of the earlier sowings in September and October, 1935, evidently sapped some of their vigour. In the spring and summer following they did not equal in growth the later sowings that had not eared at all previously. A very noticeable feature of all these over-wintered wheat plants was that from February to June they assumed an abnormally erect growth habit, the leaf tips pointing vertically upwards instead of lopping over in the usual manner.

Table VIII illustrates the behaviour of a typical winter variety, Queen Wilhelmina, when sown in 1935, before, on, and after its critical sowing date for ripening. It will be seen that sowings made too late to ripen in 1935 ripened normally in 1936. But for the fact that the first three March sowings were ploughed up in autumn they would probably have produced successful crops in 1936.

TABLE VIII.

Behaviour of Queen Wilhelmina Wheat, in Successive Sowings, Made from 6th February to 21st May, 1935.

Date of Sowing 1935	Date of Exsertion of First Ears 1935	Date when fully Eared 1935	Date of Ripening 1935	Remarks on Ripening 1935	Date of Exsertion of First Ears 1936	Date when fully Eared 1936	Date of Ripening 1936	Remarks on Ripening
6th February	27th June	5th July	26th August	Good Crop	—	—	—	—
13th ,,	30th ,,	10th ,,	28th ,,	,,	—	—	—	—
21st ,,	4th July	14th ,,	12th Sept.	Fair Crop	—	—	—	—
4th March	10th ,,	22nd ,,	2nd October	Only a few ears	—	—	—	—
11th ,,	16th ,,	6th August	Did not ripen	—	—	—	—	—
19th ,,	29th ,,	5th Sept.	,,	—	—	—	—	—
25th ,,	7th August	Did not ear fully	,,	—	6th June	21st June	18th August	Fair Crop
1st April	15th ,,	,,	,,	—	8th ,,	22nd ,,	19th ,,	,,
8th ,,	18th ,,	,,	,,	—	10th ,,	24th ,,	21st ,,	Good Crop
15th ,,	15th Sept.	,,	,,	—	10th ,,	24th ,,	20th ,,	,,
22nd ,,	1st October	,,	,,	—	6th ,,	22nd ,,	19th ,,	,,
29th ,,	Did not ear	—	—	—	8th ,,	23rd ,,	20th ,,	,,
6th May	,,	—	—	—	9th ,,	23rd ,,	20th ,,	,,
13th ,,	,,	—	—	—	8th ,,	23rd ,,	19th ,,	,,
21st ,,	,,	—	—	—	8th ,,	23rd ,,	19th ,,	,,

The duration of the period from sowing to ear exsertion varies according to the variety, being longest in the case of the slow winter variety Steel, and shortest for the rapid spring variety Aurora. It is however a remarkable fact that the period from exsertion to ripening is almost the same for all varieties. It is also nearly constant for all sowings of each variety made sufficiently early to ripen by the end of August. It fluctuates, however, from year to year. It averaged 57 days in 1934-1935 ; 64 days in 1935-1936 ; 65 days in 1936-1937 ; 72 days in 1937-1938 ; and 69 days in 1938-1939.

During each of these five seasons, the interval from exsertion to ripening did not vary more than four days, and rarely more than two days, from the above averages for any variety or for any sowing ripening by the end of August. But when maturity is not reached till September this interval increases rapidly, though somewhat irregularly, with successive sowings until the crop fails.

A study of Table XIII shows that generally speaking all sowings of all varieties beginning to ear in June ripened satisfactorily in August or the first week of September, and that those earing in the first week of July ripened in the second week of September. If they did not begin to ear till the second week of July, they were unable to ripen till very late in September or early in October, while occasionally they failed to ripen at all. This was the case, especially in 1938, when all but the early sowings were retarded in ripening by a week or more due to the wet and sun-deficient weather which prevailed in July, August, and September of that year. Sowings of winter varieties that did not begin to ear until 15th July or later were seldom able to ripen. But sowings of spring varieties in the 1935-1936 and 1936-1937 seasons which eared in the third week of July ripened successfully at the end of September.

Consequently, it can be easily predicted on the date of exsertion whether wheat will be likely to ripen or not.

This leads to a consideration of the factors influencing the most crucial stage in the life-history of the wheat plant, namely, the stage between emergence over ground and the exsertion of the first ears.

These factors although interacting with one another and difficult to segregate may be grouped under the following headings :—

1. Time of Sowing.

2. Nature of Variety.

3. Climatic Conditions.

Time of Sowing.—No matter how early wheat is sown, it hardly ever begins to ear in this country before 1st June. During the five years of the experiment the only exception to this rule was winter-sown Aurora in the 1937-1938 season, which began exserting on 24th May.

The winter varieties, sown from 25th March to 21st May, 1935 and allowed to over-winter, did not produce their first ears in 1936 until 6th June.

Spring varieties sown in November and early December each year began exserting in the following summer between 1st June and 17th June, depending on the particular variety and the season. Successive sowings of spring varieties such as April Red and Diamant made up to late April and of Red Marvel up to early April eared in rapid succession during June. In the case of the winter varieties Steel, sown up to early February, and Queen Wilhelmina and Yeoman II sown up to late February or even early March in certain seasons, also eared in June.

During the sowing periods referred to for the different varieties, a delay of a week or ten days in sowing rarely caused a delay of more than one day in earing, while frequently sowings spread over a month eared on the same day in June and subsequently ripened on the same day in August or early September.

As regards the plots that had been sown too late to begin to ear in June, the speed of reaching the exsertion stage slowed down gradually in the case of the spring varieties, but very rapidly in the winter varieties so that the latter soon failed.

Nature of Variety.—Varieties from the different groups behave quite differently when sown on the same day, even when sown early in winter. For instance, Steel sown on 20th November, 1936, eared on 15th June and ripened on 20th August, 1937, while April Red sown on the same day eared on 7th June and ripened on 15th August, 1937. As sowings are made progressively later, this difference in rate of development becomes accentuated until the winter variety fails, while the spring variety has ample time to ripen. Steel sown on 10th March, 1937, did not begin to ear until 24th July of that year and failed to ripen any grain. April Red sown on the same day eared on 18th June and ripened on 23rd August, 1937, while sowings of this variety up to the end of April all ripened in August of that year. Varieties of types, ranging between Steel and April Red in nature, behaved in an intermediate manner in all respects.

Climatic Conditions.—The various types of weather encountered by the crop from sowing time onwards directly affect its rate of vegetative growth, mild weather with sunshine and showers encouraging growth,

while cold, harsh weather retards it, but there is also an indirect effect of weather to be taken into account.

Lyssenko (32), in his vernalization theory, contends that the life-history of a plant may be divided into the two processes—growth and development. (In this case, "growth" means vegetative growth, and "development" means the attainment to the reproductive stage and maturity).

These two processes are independent of one another, that is, a plant may grow without developing and *vice versa*. Weather conditions influence both processes, sometimes in harmony, but occasionally favouring one at the expense of the other. Growth is always favoured by warmth but in many plants development demands a period of cold in the early stages. This is where spring and winter wheats differ. True spring varieties like April Red grow best and develop from the outset in warm sunny weather. Winter varieties like Steel, on the other hand must, when young, experience a period of cold if they are to develop normally. Here cold is the essential factor that, by its stimulating effect, initiates the reproductive phase. In its absence, winter varieties are extremely slow in coming into ear and usually fail to ripen in the same season. Provided winter wheat has experienced low temperature, it is thereafter favoured in both growth and development by warm, sunny weather as in the case of spring wheat; but without the initial cold, it cannot respond to the most favourable weather.

This effect of cold on winter wheat has been termed "vernalization" by Lyssenko. Winter wheat can be artificially vernalized by germinating the seed and subjecting it then to a temperature slightly above freezing point for several days before sowing. It is reported that in Russia upwards of 1,250,000 acres of vernalized winter wheat are sown in spring and followed by good crops (3). In recent years, vernalization has been tried in many countries, with very variable results—probably due to the particular varieties experimented with.

Caffrey and Carroll (7) have shown, that while vernalization definitely accelerates the development and subsequent ripening of spring-sown winter wheat in Ireland, the treatment falls far short of causing a winter variety to behave as a spring variety. Further, they point out that as we have available heavy-yielding varieties of spring wheat the necessity for vernalization does not arise here. Although artificial vernalization may be ruled out in our wheat growing, "natural vernalization" must, however, be taken into consideration. A cold late spring may to a certain extent be equivalent to winter in its effects on spring-sown winter wheat.

As a rule, the common varieties of winter wheat succeed when sown up to early February irrespective of the season. With each day's postponement of sowing after the middle of February they become more and more dependent

upon subsequent weather, especially temperature conditions in March and April and sunshine and rainfall in summer and early autumn.

These weather factors varied considerably from year to year during the period of the experiment—1935 to 1939, inclusive. The behaviour of the wheat varieties under trial when sown on corresponding dates also differed markedly. So it may be possible to trace a correlation between weather conditions and wheat development.

Temperatures ranging from 32°F. to 40°F. have been found to be effective in vernalizing winter wheat under artificial conditions. In nature however it is likely that night air temperatures of slightly below 32°F. are necessary as the main body of the plant is protected by soil.

During the five years 1935-1939 the number of nights in March and April on which freezing occurred were as follows :—

	March	April	Total
1935	8	6	14
1936	7	11	18
1937	22	2	24
1938	8	16	24
1939	10	7	17

If cold spring weather is beneficial to late-sown winter wheat, then the years 1936, 1937 and 1938 should be more favourable than 1935. Spring cold merely prepares the plant for development, the actual rate of which is determined later by sunshine and rainfall. Results showed that the years 1936 and 1937 were much more favourable and that 1938 was slightly more favourable than 1935.

The following comparisons will serve to illustrate the effects of the different years on Queen Wilhelmina and Yeoman II :—

TABLE IX.

QUEEN WILHELMINA.

Year	Date of Sowing	Date of Exsertion	Date of Ripening	Date of Sowing	Date of Exsertion	Date of Ripening
1935	21st Feb.	4th July	12th Sept.	11th March	16th July	failed
1936	20th ,,	27th June	26th Aug.	10th ,,	30th June	7th Sept.
1937	17th ,,	23rd ,,	26th ,,	10th ,,	30th ,,	2nd ,,
1938	18th ,,	24th ,,	2nd Sept.	11th ,,	13th July	8th Oct.
1939	15th ,,	19th ,,	26th Aug.	8th ,,	25th June	3rd Sept.

TABLE X.

Yeoman II.

Year	Date of Sowing	Date of Exsertion	Date of Ripening	Date of Sowing	Date of Exsertion	Date of Ripening
1935	21st Feb.	1st July	10th Sept.	19th March	12th July	16th Oct.
1936	20th „	24th June	25th Aug.	19th „	3rd „	5th Sept.
1937	17th „	23rd „	25th „	22nd „	2nd „	4th „
1938	18th „	22nd „	29th „	18th „	11th „	18th „
1939	(Yeoman II was not sown in the trials in 1939)					

Other winter varieties sown in 1935 and in one or more of the succeeding years gave results similar to the above.

The weather data presented in Table XI show that for the six months' period—April to September—temperatures on the average did not vary much in the different years but that the amount of rainfall and sunshine varied a great deal.

TABLE XI.

	Rainfall in Inches							Sunshine in Hours						
Year	April	May	June	July	Aug.	Sept.	Total	April	May	June	July	Aug.	Sept.	Total
1935	1.95	1.76	2.88	0.82	1.40	3.80	12.61	100	212	176	238	195	133	1054
1936	1.91	1.33	3.08	5.24	1.14	2.83	15.53	130	172	236	176	229	111	1054
1937	1.80	1.34	1.24	1.96	2.69	1.45	10.48	76	212	128	165	198	134	913
1938	0.09	2.75	2.91	4.49	2.66	1.49	14.39	195	151	144	111	143	95	839
1939	2.08	0.66	1.46	2.81	2.09	4.60	13.70	157	201	248	142	197	105	1050

The years 1935 and 1936 exhibited some remarkable contrasts. July in 1935 was very dry and sunny. In 1936 it was rather dull and was the wettest month in the five years. June and August of 1936 were very sunny as compared with these months in 1935.

Early-sown winter wheat ripened considerably earlier in 1935 than in 1936, probably due to the very fine July of the former year. But mid-season and late sowings in 1936 were very much more successful than corresponding

sowings in 1935. This may be attributed partly to the cold April, but largely to the very sunny June, which encouraged exsertion, and the dry and sunny August, which favoured ripening in 1936.

The weather in 1937 was much drier than in the previous two years, but somewhat less sunny. Its net effect on wheat ripening was approximately equal to that of 1936 but early sowings ripened slightly earlier and late sowings slightly later than in 1936.

In 1938 after an abnormally dry spring, the period from May to September inclusive was rather wet and very deficient in sunshine. Early sowings of winter wheat in that year ripened quite as early as in the previous two years. In certain cases they ripened even earlier. But, when sowings were made after 1st February, 1938, each week's postponement in sowing resulted in a greater retarding in the rate of development, as compared with sowings on corresponding dates in 1936 and 1937. Furthermore, crops failed from much earlier sowings in 1938 than in 1936 and 1937. For instance, Queen Wilhelmina failed in 1938 when sown on 18th March. In 1936 and 1937 only sowings made as late as 9th April and 7th April respectively, failed.

It is therefore apparent that 1938 was far less favourable than 1936 or 1937 for late-sown winter wheat. Evidently the dull wet summer and autumn counteracted the beneficial effects that should have resulted from the cold April of that year.

The spring of 1939 was wet but the succeeding months from May to August, inclusive, were very dry and sunny, the corresponding months being drier only in 1935, and sunnier only in 1935 and 1936. As regards spring temperatures in 1939, there were fewer nights of actual freezing in March and April of that year than there had been in the corresponding months in the previous three seasons although the weather was, on the average, unusually cold for the time of year.

This season proved to be very favourable for wheat and relatively late sowings of both winter and spring varieties were highly successful. Queen Wilhelmina ripened in 1939 on 3rd September when sown on 8th March, although in 1938 it did not ripen until 20th September when sown on 4th March. Furthermore, while the 18th March sowing of this variety in 1938 failed to ripen, the 22nd March sowing in 1939 was fully ripe on 25th September. The great superiority of 1939 over 1938 for late-sown winter wheats may be attributed partly to its much colder March and slightly colder April (mean temperature) but mainly to its abundant sunshine and low rainfall during the period May to August, inclusive.

The effects of the different years were also reflected in the results obtained from spring wheats. The varieties Red Fife and Marquis when sown in winter

ripened as much as ten days earlier in 1935 than in 1936. In the case of sowings made about 1st February the difference decreased while sowings made at the end of February ripened on about the same date in August in both years. Then the order changed. Sowings made after 1st March developed with increasing rapidity in 1936 as compared with 1935 so that sowings made at the end of April, 1936, ripened a fortnight earlier in that season as compared with the date of ripening during the 1935 season of sowings made at a corresponding time. When sown towards the end of May these varieties ripened only a few days earlier in 1936 than in 1935.

In 1937 the ripening date of comparable sowings of the variety April Red was slightly earlier in that year than in 1936, especially in the case of very late sowings, *i.e.*, those made from mid-May to 10th June. Incidentally, 10th June was the latest sowing date recorded in these experiments to give ripe grain.

In 1938, spring varieties sown up to mid-February agreed in ripening time with similar sowings made in 1936 and 1937. When sown after mid-February their rate of development did not keep pace with that established in 1936 and 1937 and eventually failure occurred in much earlier sowings.

April Red sown on 13th May, 1938, failed but when sown on 13th May, 1936, and 12th May, 1937, it ripened and produced good crops on 11th September, 1936, and 10th September, 1937, respectively. In 1937, only sowings of this variety made on 16th June failed completely.

Again, in the dry and sunny season of 1939, early sowings of spring varieties were slightly more successful and very late sowings were much more successful than the corresponding sowings in 1938. April Red sown on 17th May, 1939, (the latest sowing made in 1939) was fully ripe on 18th September. Other fast-growing spring varieties behaved in a manner similar to that of April Red in the various years, while slow-growing spring varieties of the Red Marvel class occupied an intermediate position. (See Tables XIII and XIV). Therefore, even spring varieties, especially when late sown, are directly affected by the climatic conditions they encounter in summer and autumn ; a dull wet season retards and a sunny dry season hastens their progress.

INFLUENCE OF FERTILIZERS.

To test the effect of various artificial fertilizers on the time of ripening of wheat, a manurial trial was conducted in 1936 in conjunction with the time-of-sowing experiment. A number of single fertilizers and a complete mixture were used. In all there were five different dressings. The treatment was as follows :—Half of each sowing was manured, the other half being left as control. The treated parts were arranged at random.

The fertilizers used and the quantity applied per statute acre were :—

First sowing received	sulphate of ammonia	@ 1 cwt. per acre.	
Second „ „	nitrate of soda	@ 1 „ „	
Third „ „	superphosphate 35%	@ 3 „ „	
Fourth „ „	muriate of potash	@ 1 „ „	
Fifth „ „	1 cwt. sulphate of ammonia. 3 cwt. superphosphate 35% 1 cwt. muriate of potash		@ 5 cwt. per acre.

These dressings were replicated four times on the first 20 sowings. The remaining 6 sowings got sulphate of ammonia only. The first 10 sowings received their manurial treatments on 7th April. Later sowings were dressed as soon as they were about 3″ high.

Results.—As mentioned earlier, the soil was already in a fairly high state of fertility. Consequently the crop gave little or no response to the dressings of phosphate or potash but the complete mixture and the nitrogenous fertilisers applied alone produced a decidedly more vigorous growth. Evidently it was nitrogen only that was effective. It increased the foliage, height and yielding powers of the plants. Despite this difference in vegetative growth the first ears invariably appeared in both manured and unmanured portions of each plot on the same day. The subsequent rate of development showed little or no difference. Actual ripening tended to occur on the same day in both portions.

Nitrogen in certain cases induced ripening a day earlier or a day later but it never caused a departure of more than two days from the date of ripening in the control portion. Phosphate and potash, while they had practically no effect on vegetative growth, likewise showed no influence on the time of ripening. They might have been more effective had they been applied in early spring. As against this, the summer of 1936 was very showery and should have enabled these manures to show some effect.

In 1937 the effect of sulphate of ammonia was again tested. It was applied to half of each sowing, the other half being left as control. Half of each of the first 15 sowings received sulphate of ammonia at the rate of 1 cwt. per acre on 21st May. On that date the winter varieties in the first sowing ranged from 15 inches to 20 inches, while the spring varieties were up to 24 inches high. The other 14 sowings graded down by steps to the 15th which had just emerged. Growth was rapid at this time and rain which fell on the night after application washed in the manure completely.

Subsequent sowings were dressed with sulphate of ammonia at the rate of 1½ cwts. per acre as soon as they were 2 inches or 3 inches high.

In all the sowings the plots were reasonably uniform and the plants of a healthy dark green colour at the time of manuring. Still the effect of sulphate of ammonia was soon apparent. It caused the treated portion of each plot to become more leafy and somewhat ranker than the untreated. Notwithstanding this it had no effect on the rate of development. In a few cases it accelerated or delayed ear exsertion by one day only. In no case did it alter the date of ripening. At the same time it increased the height of the straw by about 3 inches on an average and it also apparently increased the yield of grain.

The interesting and important point is that nitrogen at the above rates of application while it increased the yield of both straw and grain did not retard ripening.

SOWING TIME AND DISEASE.

The only diseases to become rather prevalent in these sowings were yellow rust (*P. glumarum*) and brown rust (*P. triticina*), while glume blotch (*Septo rianodorum* Berk.) also appeared. In 1935 yellow rust appeared early in April and soon became general. Marquis was most seriously damaged and Million and Yeoman II to a less extent. The remaining varieties showed somewhat more resistance.

Early sowings being considerably developed before the rust attack suffered least. As the fungus was most virulent during May, June and early July, moderately late sowings were most affected. After mid-July the rust diminished so that the very late-sown spring varieties were only slightly attacked.

In 1936 pustules of yellow rust could not be found until 12th June, and even then the disease spread very slowly. It slightly injured Marquis and Diamant but had practically no effect on the other varieties. Again it was not much in evidence after the middle of July.

In 1937 yellow rust appeared on 12th May. It spread fairly rapidly until mid-July after which it began to abate. Due to its earlier appearance it was more injurious than in the previous year and moderately late sowings suffered considerably.

Yellow rust was found early in April in 1938 and it then spread rapidly, becoming general by 1st June. It did considerable damage to Yeoman II, Diamant and Aurora especially in mid-season and late sowings. Early sowings of these varieties and all sowings of the other varieties were only slightly affected.

Aurora behaved in a remarkable manner. It appeared to be immune to

yellow rust until the end of June when it contracted the disease rather suddenly. Then within a week all plants of this variety, irrespective of their stage of growth, showed long stripes of yellow rust. Evidently Aurora was resistant to the forms of Yellow Rust attacking the other varieties but was itself attacked in July by a special biologic form to which it was susceptible.

In 1939 yellow rust though observed on 20th April did not spread much until mid-May when it could be found on all the varieties under test. Later it became moderately severe on Holdfast and Desprez 80 and very severe on Fylgia and Aurora especially in mid-season sowings.

Brown rust (*P. triticina*) did not appear in any year until July and did not cause serious damage. Early sowings almost entirely escaped its attack while later ones were only slightly affected. The variety Mansholt's Van Hoek which is highly resistant to yellow rust proved to be quite susceptible to brown rust. Juliana was also very susceptible to it. The other varieties were much more resistant to brown rust but none of the 19 varieties under test was completely immune to either rust.

Glume blotch (*Septoria nodorum* Berk.) appeared to a certain extent each year especially in the early sowings. It had little effect on the winter varieties but caused considerable smudging to the glumes and shrinkage of the grain in the spring varieties that had been sown in winter. Later sowings of these varieties contrasted markedly in having bright chaff and plump grain.

SOWING TIME AND YIELD.

The yield of a wheat crop is determined by the number of ears per unit area together with their size and degree of filling. A reasonably good crop carries about 300 ears per square yard. Crop density is decided mainly by the rate of seeding and partly by tillering and soil fertility. Late sowings have little time to tiller and consequently must be sown more thickly.

Large well-filled ears are usually borne on straws that are tall for the particular variety. Each variety has its own optimum height for yield. When shorter it yields less while if taller it may lodge and yield less still. Hence crop density and straw height may be taken as indicators of grain yield. Both of these factors are directly influenced by sowing time. When sown early the crop has a longer period in which to tiller and to grow tall before exsertion than when sown late.

Maximum straw height usually declines steadily with lateness of sowing, especially when the summer is dry. A showery summer tends to even up successive sowings in bulk and grain yield.

Taking sowings that ripened before the end of September the following results were obtained :—Queen Wilhelmina is taken as representative of the winter varieties in all five years and the spring varieties are represented by Marquis in 1934-1935, and by April Red in the succeeding four years.

In 1934-1935 the maximum height of Queen Wilhelmina declined from 52 inches to 42 inches and Marquis declined from 55 inches to 30 inches. In 1935-1936 Queen Wilhelmina decreased from 57 inches to 45 inches and then in later sowings increased to 50 inches due to a very wet July. Similarly April Red dropped from 64 inches to 50 inches and then increased to 55 inches.

In both of the seasons 1936-1937 and 1937-1938, Queen Wilhelmina declined from 56 inches to 50 inches and April Red from 62 inches to 52 inches. In 1939 the Queen Wilhelmina sowings fluctuated slightly around 48 inches while April Red declined from 52 inches to 48 inches and later increased to 52 inches again.

The crops were not weighed as the plots were too small to give reliable results especially in the absence of replication and furthermore they had been somewhat injured by birds but it was obvious that in the case of the winter varieties yield declined, at first slightly and later on seriously, with lateness in sowing.

Spring varieties like April Red behaved differently. When sown in winter and early spring they grew too tall and lodged. This together with the attack of glume blotch mentioned earlier considerably reduced their yields. April Red gave the most satisfactory crops when sown in April, while the intermediate variety, Red Marvel, did best when sown in February or March.

EFFECT OF SOWING TIME ON THE RESULTING GRAIN FOR SEED.

It has been suggested that in sowing wheat rather late it would be desirable to use seed derived from a late-sown crop. An experiment was therefore conducted in 1937 with Red Marvel to test the validity of this suggestion. Samples of seed were retained from the crops resulting from the early, late and very late 1936 sowings. These were sown side by side on each of three dates in 1937. Table XII sets out the details of this experiment with Red Marvel.

TABLE XII.

Dates of 1936 Sowings from which seed was derived	Date of Sowing	Date of Emergence	Date of Exsertion of First Ears	Date of completion of Exsertion	Average maximum Height	Date of Ripening
					Inches	
2nd January, 1936	18th February, 1937	25th March, 1937	17th June, 1937	27th June, 1937	50	26th August, 1937
2nd April, 1936 ..	,, ,,	,, ,,	,, ,,	,, ,,	50	,, ,,
7th May, 1936 ..	,, ,,	,, ,,	,, ,,	,, ,,	50	,, ,,
2nd January, 1936 ..	22nd March, 1937	12th April, 1937	24th June, 1937	4th July, 1937	49	30th August, 1937
2nd April, 1936 ..	,, ,,	,, ,,	,, ,,	,, ,,	49	,, ,,
7th May, 1936 ..	,, ,,	,, ,,	,, ,,	,, ,,	49	,, ,,
2nd January, 1936 ..	20th April, 1937	1st May, 1937	5th July, 1937	15th July, 1937	49	9th September, 1937
2nd April, 1936 ..	,, ,,	,, ,,	,, ,,	,, ,,	49	,, ,,
7th May, 1936 ..	,, ,,	,, ,,	,, ,,	,, ,,	49	,, ,,
13th May, 1936 ..	,, ,,	,, ,,	,, ,,	,, ,,	49	,, ,,

It will be seen from the above Table that the time of sowing of the crop from which the seed was obtained had not the slightest effect on the behaviour of the resulting crop. Seed from May sowings did not induce ripening to occur any earlier than did seed from January sowings. Furthermore, the crops produced from the different seed samples were exactly alike in straw height and vigour and apparently also in yielding capacity. Incidentally it is worth noting that the grain derived from Red Marvel sown on 13th May, 1936, though rather small, had ripened fully on October 5th, 1936, and produced a normal crop when sown on 20th April, 1937.

DISCUSSION.

The various growth and developmental phases of wheat are conditioned by the whole complex of genetic and environmental factors. This applies especially to successful grain production. Environmental factors have a profound influence but may be rendered impotent by an unsuitable plant response. On the basis of response to environment varieties have been divided into two groups—spring and winter varieties. (Intermediate forms also occur).

Spring varieties have such a strong inclination for early seed formation that they will ear, flower, and attempt to mature under the most unfavourable circumstances.

Winter varieties behave differently. They may ear too late to ripen properly but when the chances of ripening vanish entirely they refuse to ear in the year of sowing and await the return of favourable weather in the following year. They will then ear and ripen only a few days earlier than normal.

Temperature and light play a very important part in seed production in many plants including wheat, while rainfall and soil fertility have some influence. Of these, the latter is the only factor under direct human control and although it is the major factor in determining yield it has but a very slight effect on the time of maturity.

Rainfall as shown by Cole and Matthews (9) and by the writer's observations has a decided influence. A high rainfall prolongs the pre-earing stage by a few days but its most obvious effect is shown after earing when it may retard ripening by a week or more. Wheat, especially spring varieties, grows and develops in proportion to the temperature up to a certain limit. Winter varieties also benefit by warmth provided they have experienced a temperature of about zero in their early stages. Otherwise they are unable to respond to the most favourable summer weather. This is where natural vernaliza-

tion assumes prime importance especially as winter wheat is so frequently sown in February in Ireland.

The most effective means available to us for ensuring early and satisfactory ripening lies in the sowing of each variety within its proper time limits. One slight objection to autumn sowing is that it favours weed establishment which may become serious if two or more crops of wheat are taken in succession—not a desirable practice.

While early sowing ensures success quite as good results are often obtained when the operation is postponed until nearly the latest safe sowing date for the variety, but much depends upon subsequent weather. Such postponement can often be avoided, as wheat will tolerate being sown when the soil is very wet and in the absence of actual water-logging will suffer no injury.

Fortunately however should unfavourable weather render winter sowing impossible, ordinary winter varieties, like Queen Wilhelmina, Squarehead Master and Ironmaster, can be sown with perfect safety up to 10th February. On fertile land they will give normal yields when sown on this date. They can be expected to ripen satisfactorily when sown on the last days of February, or in occasional years as in 1936, 1937 and 1939, up to 10th March. March sowing of winter wheat entails considerable risk and it is safer then to sow a spring variety such as Red Marvel or Atle.

It may be taken that each day's delay in sowing winter wheat after 10th February will be followed by a proportionate reduction in yield. Yeoman II can be sown about 10 days later than the winter varieties specified above but Pajbjerg should be sown 10 days, and Steel at least 20 days, earlier than them.

No matter what the variety used or the time of sowing wheat will rarely ear before 1st June or ripen before 1st August in this country. Generally speaking, during the course of this experiment spring varieties sown in winter began earing in the first or second week of June, while winter varieties sown at the same time began earing in the second or third week of June, according to season.

Wheat sown in October or November will have more tillering done by spring than if it has been sown in December or January but in respect of development towards earing will have made very little more progress. Consequently in these experimental sowings winter wheats sown from November to the end of January, and in certain cases up to the end of February or even early March, as in the case of Yeoman II, eared in very rapid succession and all ripened within a period of 4 to 10 days towards the end of August. April Red sown from November to the beginning of April in 1937-1938 and from November to the end of April in the previous two seasons

all ripened during the last fortnight of August. The other fast-developing varieties ripened with equal rapidity while Red Marvel and Mansholt's Van Hoek occupied an intermediate position.

Viewed from another aspect, it is seen that the number of days from sowing to ripening diminished steadily with lateness of sowing up to the critical date after which an abrupt increase preceded crop failure.

In these experiments the period between sowing and ripening for successive sowings of winter varieties decreased on an average from 275 to 165 days and then increased again, while for the spring varieties the corresponding period decreased from 160 to 120 days approximately.

The shortest life cycle recorded for any variety was for Marquis. Sown on 7th May, 1936, it ripened in 116 days. Later evidence showed that Aurora could ripen in 2 days less than Marquis but it was not sown in 1936.

Ripening conditions are at their best during the first three weeks of August. They are usually still quite good in the last week of August and the first week of September. After this, conditions are liable to become unfavourable. Long nights with heavy dew and fog often accompanied by dull days retard ripening. However, though the process becomes slower, it is possible for wheat to ripen thoroughly up to mid-September and even up to the end of the month if the weather is warm and dry. From a practical point of view, a wheat crop cannot be considered satisfactory if it has not ripened at latest by the middle of September. It should preferably be ripe by the end of August.

When these crops were recorded as " ripe " they were in the fully " ripe " stage, the grain being hard and all trace of green having disappeared from the top node (the last part of the plant to lose its greenness). They could without harm have been harvested 2 or 3 days earlier or on the other hand a few days later, as ripe wheat will stand without shedding for a week or more if necessary. While even rough weather will not shed ripe wheat an over-ripe crop must be carefully handled in harvesting operations or serious loss will result.

By experiment the writer found that all the varieties under test stood for at least a month after ripening without shedding, though of course the straw became brittle and the grain rather discoloured, while in wet weather some grain sprouted.

The tendency for successive sowings to ripen at practically the same time has an important practical bearing on wheat growing as it enables different sections of the crop sown at wide intervals of time due to bad weather to be harvested on the same day if desired.

SUMMARY.

The time of ripening of wheat is determined by variety, time of sowing and seasonal factors.

Spring varieties will ear and ripen unless prevented by weather no matter when they are sown. To give a reasonable yield, they must be sown within the proper season—February to early May—according to variety.

Winter varieties, if sown after a critical sowing date in spring, characteristic for the variety, will not ear in the same year but will persist in prostrate vegetative growth until the following year when they will ear and ripen only slightly earlier than normal.

In the experiments reported this critical date occurred between the beginning and the end of April, the actual date depending upon the degree of winterness of the variety and to a certain extent on the season.

Another and more important critical date for each winter variety occurs some time in February or March. Sown after this date winter wheat will not ripen in August or it may fail to ripen at all. This critical date usually lies between 10th February and 10th March depending on variety and season.

Each winter variety has its own characteristic critical date at this stage which is liable to fluctuate from year to year within a range of at least 20 days under the influence of climatic conditions. There is a wide variation in the time of earing and consequently of ripening of different varieties sown on the same date. This difference becomes more pronounced with late sowing.

The varieties under experiment eared in the same order and in the case of the winter varieties the critical sowing dates for earing and for ripening occurred in the same relative order in each of the five years. Critical sowing dates for ripening in winter wheats occur later in cold late springs than in those that are early and warm. Repeated late sowing does not confer upon a pure variety an adaptability to late sowing.

CONCLUSIONS.

The growth phases of wheat. such as germination, tillering, elongation, and earing are influenced by different factors in succession. They are not however completely controlled by any one factor at any time but by the interaction of several factors.

The entire course of development in the wheat plant may be analysed into four phases :—

1. *Sowing to emergence overground.*—The length of this period depends to some extent on soil moisture and depth of sowing. It is independent of variety but is under the direct control of the weather especially temperature. In cold mid-winter it has extended to 45 days while in warm late spring it has diminished to 6 days.

2. *Emergence overground to the exsertion of the first ears.*—The duration of this period is regulated mainly by time of sowing and variety but is modified by the weather. During this stage varieties exhibit their real differences of nature in the most definite manner.

3. *Appearance of first ears to the completion of exsertion and flowering.*—For this stage to be of normal length the crop must of course be pure and of vigorous growth. Its length will then depend mainly on the time of occurrence. Bright sunny weather favours it. When the first ears appear before the end of June, spring varieties complete their exsertion within about 8 days, while winter varieties do so in from 8 to 10 days.

Flowering and fertilization occur in each ear about a week after exsertion and a fortnight later the grain has attained to full adult size though it is still green and soft and contains about 70% of water. Subsequent development and ripening consist chiefly in replacing the greater part of this water by starch and protein.

4. *Exsertion to ripening.*—Spring varieties have a tendency to take about 2 days longer than winter varieties in this stage. On the whole this period is remarkably constant for all varieties and for all sowings made before the first critical sowing date. It varies, however, considerably from year to year under the influence of temperature, sunshine and rainfall. Its average length for all varieties ripening before the end of August was 57 days in 1934-1935, 64 days in 1935-1936, 65 days in 1936-1937, 72 days in 1937-1938, and 69 days in 1938-1939.

In the whole career of the wheat plant therefore variety has very little influence in deciding the duration of the first, third and fourth phases.

The second phase, namely from emergence to exsertion, is most subject to modification and control and here both variety and environment play important parts.

As soil fertility and the application of fertilisers have been shown to have very little effect on the rate of development there are but three factors left :—

Variety.
Time of Sowing.
Subsequent Weather.

Upon their interaction during this key stage depends the ultimate success of the crop. The later wheat is sown the more it becomes dependent upon the weather.

The ideal weather conditions for late-sown winter varieties are :—

1. Cold weather in March and April—to vernalize the plants.

2. Mild showery weather, with adequate sunshine from 1st May to mid-June—to encourage vigorous vegetative growth and elongation.

3. Warm sunny weather from the middle of June to the middle of September—to favour exsertion, flowering, grain filling and ripening.

These conditions from May onwards would also be ideal for very late-sown spring varieties. Any variety of wheat that has begun to ear before the end of June or has completed exsertion by 10th July will ripen by the end of August or in the first week of September in a normal season. If it has not begun to ear on 5th July or if the process is incomplete on 15th July it is unlikely to be ripe before the middle of September, while if exsertion has not begun on 15th July the crop will either fail to ripen or it will be so late that it cannot be considered of much value.

As the duration of the second and most important phase of development dealt with above is directly controlled by the three factors—variety, time of sowing, and subsequent weather, these must be regarded as the major factors in determining the time of ripening of wheat.

Acknowledgments.

I am glad to make acknowledgment to Professor J. P. Drew, M.Sc., A.R.C. Sc.I., for affording land and facilities to conduct these experiments, to Professor M. Caffrey, B.Sc., A.R.C.Sc.I., and Mr. P. T. Carroll, M.Sc., B.Agr.Sc., for helpful advice and criticism, and also to Mr. J. W. Besant, A.H.R.H.S., Keeper of the Botanic Gardens, to whose courtesy I am indebted for rainfall and sunshine data.

Reference to Tables XIII, XIV, XV, XVI.

Table XIII. See explanatory note on page 324.

Table XIV. gives for each of the 19 varieties experimented with the latest sowing date in the different years that gave a ripe crop on or before the 31st August, 15th September and 30th September, respectively. (See page 348).

Table XV. gives the latest safe sowing date for each of the 19 varieties. This "latest safe sowing date" has been selected as approximately the latest sowing date from which the variety in question can be relied upon, in an average or even in a poor season, to ripen in August or at the latest during the first week of September. (See page 350).

N.B.—The experience of the past five years has shown that each of the varieties ripened satisfactorily in August or the first week of September—in favourable seasons—when sown as much as three weeks later than their specified "latest safe sowing date." But as so much depends upon the season this procedure is too risky to be recommended.

Table XVI. gives the summarised weather data for the five years (see page 351).
(For reference note see page 324).

TABLE XIV.

Variety and Season	Latest Sowing Date to give a Ripe Crop on or before the Following Dates :—		
	31st August	15th September	30th September
Steel			
1935-1936 ..	3rd February, 1936	10th March 1936	10th March 1936
1936-1937 ..	28th January 1937	17th February 1937	17th February 1937
1937-1938 ..	18th January 1938	4th February 1938	18th February 1938
Pajbjerg			
1935-1936 ..	20th February 1936	10th March 1936	19th March 1936
1936-1937 ..	17th February 1937	10th March 1937	10th March 1937
1937-1938 ..	4th February 1938	18th February 1938	25th February 1938
1938-1939 ..	8th February 1939	15th March 1939	22nd March 1939
Juliana			
1936-1937 ..	17th February 1937	10th March 1937	22nd March 1937
1937-1938 ..	11th February 1938	18th February 1938	4th March 1938
1938-1939 ..	1st March 1939	15th March 1939	29th March 1939
Queen Wilhelmina			
1934-1935 ..	18th February 1935	21st February 1935	21st February 1935
1935-1936 ..	27th February 1936	19th March 1936	2nd April 1936
1936-1937 ..	17th February 1937	22nd March 1937	31st March 1937
1937-1938 ..	11th February 1938	25th February 1938	4th March 1938
1938-1939 ..	1st March 1939	15th March 1939	29th March 1939
Million			
1934-1935 ..	18th February 1935	21st February 1935	4th March 1935
Squarehead Master			
1935-1936 ..	27th February 1936	26th March 1936	2nd April 1936
1936-1937 ..	17th February 1937	22nd March 1937	31st March 1937
Ironmaster ..			
1934-1935 ..	18th February 1935	21st February 1935	4th March 1935
1935-1936 ..	27th February 1936	26th March 1936	2nd April 1936
1936-1937 ..	17th February 1937	22nd March 1937	31st March 1937
Yeoman II			
1934-1935 ..	18th February 1935	21st February 1935	4th March 1935
1935-1936 ..	10th March 1936	2nd April 1936	2nd April 1936
1936-1937 ..	10th March 1937	7th April 1937	7th April 1937
1937-1938 ..	25th February 1938	11th March 1938	18th March 1938
Holdfast			
1938-1939 ..	15th March 1939	29th March 1939	5th April 1939
Desprez 80			
1938-1939 ..	15th March 1939	5th April 1939	12th April 1939

TABLE XIV—*continued.*

Variety and Season	Latest Sowing Date to give a Ripe Crop on or before the Following Dates :—		
	31st August	15th September	30th September
Mansholt's Van Hoek			
1935-1936	19th March 1936	23rd April 1936	7th May 1936
1936-1937	22nd March 1937	21st April 1937	5th May 1937
Red Marvel			
1935-1936	19th March 1936	23rd April 1936	7th May 1936
1936-1937	31st March 1937	21st April 1937	5th May 1937
1937-1938	25th February 1938	1st April 1938	15th April 1938
1938-1939	5th April 1939	26th April 1939	10th May 1939
Atle			
1938-1939	12th April 1939	3rd May 1939	17th May 1939
Red Fife			
1934-1935	15th April 1935	6th May 1935	21st May 1935
1935-1936	23rd April 1936	13th May 1936	20th May 1936
April Red			
1935-1936	30th April 1936	13th May 1936	27th May 1936
1936-1937	28th April 1937	19th May 1937	2nd June 1937
1937-1938	1st April 1938	15th April 1938	29th April 1938
1938-1939	19th April 1939	10th May 1939	17th May 1939
Diamant			
1935-1936	7th May 1936	13th May 1936	27th May 1936
1937-1938	8th April 1938	15th April 1938	20th May 1938
Marquis			
1934-1935	15th April 1935	13th May 1935	21st May 1935
1935-1936	7th May 1936	20th May 1936	27th May 1936
Fylgia			
1937-1938	8th April 1938	22nd April 1938	27th May 1938
1938-1939	19th April 1939	17th May 1939	—
Aurora			
1937-1938	8th April 1938	22nd April 1938	27th May 1938
1938-1939	19th April 1939	17th May 1939	—

TABLE XV.

Latest Safe Sowing Dates.

Variety	Latest Safe Sowing Date to give a Ripe Crop by the End of August or during the First Week of September
Winter Varieties :—	
Steel	20th January
Pajbjerg	10th February
Juliana	15th ,,
Queen Wilhelmina	15th ,,
Million	15th ,,
Squarehead Master	20th ,,
Ironmaster	20th ,,
Yeoman II	1st March
Holdfast	10th ,,
Desprez 80	15th ,,
Spring Varieties :—	
Mansholt's Van Hoek	25th March
Red Marvel	25th ,,
Atle	10th April
Red Fife	15th ,,
April Red	15th ,,
Diamant	20th ,,
Marquis	20th ,,
Fylgia	20th ,,
Aurora	20th ,,

TABLE XVI.

Year and Month	Air Temperatures in Fahrenheit Degrees						Rainfall in Inches	Rainy Days	Sunshine in Hours
	Maximum Readings		Minimum Readings		Nights of 40°F. or under	Nights of 32°F. or under			
	Extremes	Mean	Extremes	Mean					
1935									
January	41-52	45	29-42	36	10	2	1.83	16	33
February	39-61	48	21-48*	35	24	9	3 94	19	57
March	44-65	54	26-46	36	20	8	0 68	8	71
April	44-65	57	27-46	36	23	6	1 95	18	100
May	45-78	60	30-49	40	15	3	1 76	8	212
June	57 77	67	34-50	48	1	0	2 88	23	176
July	69-85	74	40-58	49	1	0	0.82	11	238
August	58-81	72	38-58	49	2	0	1.40	11	195
September	55-69	63	35-59	49	3	0	3 80	22	133
October	49-66	57	26-54	40	16	5	2.27	21	87
November	45-60	49	22-44	34	26	11	3 35	18	74
December	29-51	42	16-41	30	29	19	1.72	19	41
TOTALS	--	–	–	—	170	63	25 90	194	1,417
1936									
January	33-53	43	19-44	31	28	19	3.65	22	40
February	34-53	45	22 43	33	27	12	2.10	20	64
March	40-62	51	26-46	37	19	7	1 61	16	76
April	40-67	54	26-45	34	25	11	1.91	17	130
May	54-69	61	31-46	39	21	2	1 33	11	172
June	56-79	68	31 56	44	9	2	3.08	16	236
July	62-76	68	40 54	48	1	0	5 24	27	176
August	64-84	74	40-57	48	2	0	1 14	11	229
September	57-75	66	29-56	46	3	1	2 83	16	111
October	48-65	58	28-50	39	18	3	1.44	15	86
November	38-59	48	19 42	31	28	10	2 75	18	45
December	36 49	45	25-46	34	25	13	2 47	21	22
TOTALS				-	206	89	29 55	210	1,387
1937									
January	34-50	44	22-48	32	25	13	3 67	23	25
February	38-53	47	25-42	33	25	12	3.94	24	47
March	36-52	46	25-42	31	29	22	5.18	23	82
April	43 71	57	30-50	41	14	2	1 80	15	76
May	55-74	65	34-53	41	13	0	1.34	14	212
June	61-79	71	41 57	47	0	0	1 24	14	128
July	61-81	72	41 59	50	0	0	1.96	16	165
August	66-86	75	39-57	49	1	0	2.69	10	198
September	59-74	67	35-58	45	11	0	1.45	19	134
October	48 68	57	28-51	40	17	2	3.80	12	72
November	44 57	49	22-51	36	17	11	2 10	14	39
December	32-56	43	19-42	31	28	16	2 12	21	22
TOTALS	—	–	—	-	180	78	31 29	205	1,200
1938									
January	39-55	47	25-43	34	28	8	2.82	22	33
February	40-56	48	25-47	35	22	5	0.70	14	34
March	49-62	57	26 59	39	17	8	1 01	14	88
April	52-67	61	24-47	33	25	16	0.09	2	195
May	53-73	62	23 53	41	13	4	2 75	19	151
June	58-79	67	33-60	46	4	0	2.91	21	144
July	64-80	70	42-58	47	0	0	4.49	19	111
August	64-77	69	34-56	48	5	0	2.66	16	143
September	60-76	67	31-55	44	10	1	1.49	18	95
October	46 68	57	31 54	40	19	3	4.98	27	70
November	41-64	52	26-53	39	17	9	2.86	21	50
December	31-55	43	10-43	30	29	17	3 62	24	31
TOTALS	-	--	—	—	189	71	30.38	217	1,145
1939									
January	30 54	41	17-43	29	28	19	3 80	24	32
February	37-57	48	19-49	33	21	13	2.35	20	37
March	40-56	49	26-42	34	28	9	2.62	20	88
April	43-67	56	24-47	35	26	7	2 08	13	157
May	54-77	64	25-50	39	17	2	.66	8	201
June	61-85	70	33-52	43	11	0	1.46	16	248
July	60-74	67	37-59	49	1	0	2 81	25	142
August	51-80	69	38-55	47	2	0	2.09	13	197
September	55-76	63	31-57	45	10	1	4.60	12	105
October	45-63	55	26-46	37	22	5	3.47	22	79
TOTALS (10 months)		—	–	—	166	56	25.94	173	1,286

REFERENCES.

1. Bayles, B. B., and Martin, J. F. Growth habit and yield in wheat as influenced by time of seeding. Jour. Agr. Res. 42 : 483-500 1930.

2. Bell, G. D. H. Crops and plant breeding. Jour. Royal Agr. Soc. of England 96 : 159-199. 1934.

3. Bell, G. D. H. Experiments on Vernalization, Jour. of Agr. Sci. 26 : 155-171. 1936.

4. Bell, G. D. H. Vernalization : Its meaning and practical application. Agr. Progress 13 : 76-82. 1936.

5. Biffen, R. H. and Engeldow, E. F. Wheat breeding investigations at Cambridge. Res. Monograph No. 4. Br. Min. Agr. & Fish. 1926.

6. Board of Agr. & Fisheries. Food production leaflet No. 38, Wheat Growing, 1918.

7. Caffrey, M. and Carroll, P. T. Vernalization, its principles and practice. Jour. Saorstat Eireann Dept. of Agr. Vol. XXXIV : 53-62. 1936.

8. Clarke, J. Allen, Martin, J. H. and Parker, J. H. Comparative hardiness of winter wheat varieties. U.S.D.A. circ. 378. 1926.

9. Cole, J. S. and Mathews, O. R. Use of water by spring wheat on the Great Plains. Office of Dry Land. U.S.D.A. Bull. 1004, 1923.

10. Delwiche, E. J. and Leith, B. D. Wheat growing in Wisconsin. University of Wisconsin Agr. Circ. 198, 1926.

11. Evans, A. T. and Janssen, G. Winter wheat in South Dakota. S Da. Agr. Exper. Stn. Bull. 200. 1922.

12. Forster, H. C. Response of English and Australian wheats to length of day and temperature, Jour. Aust. Inst. Agr. Sci. 1935.

13. Hardies, E. W. and Hume, A. N. Wheat in South Dakota. S. Da. Agr. Exper. Stn. Bull. 222. 1927.

14. Hume, A. N. and Evans, A. T: Some experiments with spring wheat in South Dakota. S. Da. Agr. Exper. Stn. Bull. 201. 1923.

15.	Jour. Dept.	Agr. and	Tech.	Inst.	Ireland	Vol.	IX (1909).
16.	,,	,,	,,	,,		,,	X (1910).
17.	,,	,,	,,	,,		,,	XII (1912).
18.	,,	,,	,,	,,		,,	XV (1915).
19.	,,	,,	,,	,,		,,	XVII (1917).
20.	,,	,,	,,	,,		,,	XVIII (1918).
21.	,,	,,	,,	,,		,,	XIX (1919).
22.	,,	,,	,,	,,		,,	XX (1920).
23.	Jour. Dept. Agr. Saorstat Eireann,					,,	XXVIII (1929).
24.	,,	,,	,,	,,		,,	XXX (1931).
25.	,,	,,	,,	,,		,,	XXXII (1933).
26.	,,	,,	,,	,,		,,	XXXIII (1935).
27.	,,	,,	,,	,,		,,	XXXIV (1936).
28.	Jour. Dept. Agr. Eire,					,,	XXXV (1938).

29. Kessler, W. Uber die inneren Ursachen der Kälteresistenz der Pflanzen. Planta 24 : 312-352. 1935.

30. Kiesselbach, T. A. Winter Wheat Investigations. U.S.D.A. Exper. Stn. Rec. 55 : 135-136.

81. Leigty, C. E. and Taylor, J. W. Rate and date of seeding and seed-bed preparation for winter wheat at Arlington Exper. Stn. U.S.D.A. Tech. Bull. 38. 1927.

82. Lyssenko, T. D. The physiology of plant development in breeding work. Semenovodstvo 2 : 20-31. 1934.

83. Martin, J. H. Comparative studies in winter hardiness in wheat. Jour. of Agr. Res. 35. No. 6. 1927.

84. Mudra, A. Zur Physiologie der Kalteresistenz des Winterweizens, Planta (Berl) 18 : 435-478. 1932.

85. Perceival, J. The Wheat Plant. A monograph 463 pp. illus. London. 1921.

86. Russell, E. J. The Rothamsted experiments on the growth of wheat 1843-1933. Paper in Proc. World's Grain Exhibition and Conference, Regina 1933. 2 : 332-344 illus. 1933.

87. Suneson, C. A. and Kiesselbach, T. A. Differential varietal responses of winter wheat to time of planting. Jour. Amer. Soc. Agron. 26 : 294-296.

88. U.S. Dept. Agr. Yearbook 1919.

(Received for publication on 8th January, 1940).

GLASNEVIN ARDRI OATS.

By

M. Caffrey, B.Sc., A.R.C.Sc.I., Plant Breeding Department,
University College, Dublin.

One of the aims of the Plant Breeding Department of University College, Dublin, is the production and propagation of prolific, well-adapted types of spring oats producing straw sufficiently strong to resist lodging when sown on rich soils. Four varieties :—Victory II, Glasnevin Sonas, Potato (Ardee) and Glasnevin Success, have already been put on the market and are now widely grown in this country. The present note deals with yet another new oat variety, Glasnevin Ardri, which combines yielding capacity, strength of straw, and other valuable agronomic characters in a greater degree than any other oat variety yet produced in this country.

Glasnevin Ardri has been derived from a crossing, made in 1926, between Glasnevin Sonas and Victory II. It was hoped in making this particular cross that among the progeny would be found individuals combining the high yielding capacity, the ability to resist attacks of 'leaf stripe' disease and the strength of the straw which characterise Glasnevin Sonas, with the superior adaptability to different soil and climatic conditions, and the high grain quality which are typical features of Victory II.

There are, broadly, two methods of dealing with the hybrid progenies of those plant species which normally reproduce themselves by self-fertilization. One is to grow on, for from five to ten years, representative bulk samples of seed of each successive generation and eventually to take single plant selections from the final propagation. It is claimed that this method will, in the first place, eliminate all markedly inferior strains through the agency of natural selection. In addition the majority of the plants eventually selected will have become reasonably true to type and will therefore transmit their distinctive characters to their separate progenies.

The other method is to make the initial selections as early as the F_2 Generation—the second generation following the crossing. This avoids the long delay inherent in the method previously described but it has the disadvantage that the majority of the selected plants are in a very hybrid condition. Progenies of hybrid plants exhibit great variation owing to the recombination of the Mendelian characters in which the selected plants were heterozygous. Moreover, there is likely to be a falling-off in the standards of yield and quality

owing to the loss of hybrid vigour. These two results acting together make it rather difficult to obtain in the pure breeding descendents of selected hybrids progenies having unimpaired all the good qualities for which the original plants were selected.

It is therefore necessary when selections are made from the F_2 Generation to take as many outstanding plants as it is conveniently possible to handle. The individual progenies should be carefully watched during the period of growth and development so as to determine the lines which best combine desirable agronomic characters with trueness to type. All progenies having tall, weak straw or the grain produce coarse, chaffy, thin, or infertile, should be ruthlessly discarded. These particular types are liable to have their unfavourable traits more accentuated in subsequent generations, and their retention only leads to trouble, waste of time and loss of valuable ground space.

In the Glasnevin Sonas—Victory II cross, a large number of individual plant selections was made in the F_2 generation, that is, during the harvest of 1928. Reselections confined to the most promising lines were continued in the *third*, *fourth* and *fifth* generations. At this stage it was decided to propagate five selections, four being from one outstanding line and the other from a line which also appeared to be very good. In 1932 sufficient seed was available to test these five new stocks in small scale (chessboard) experimental plots using Victory II as control. Twelve plots of each variety were included in the quantitative test and the experiment which comprised 72 plots was arranged in two 6 x 6 latin squares. This permitted the analysis of variance to be taken.

Variety	Total Yield of Grain from 12 Plots	Taking Victory II as Zero
Victory II	5160 grams	
Glasnevin Sonas—Victory II 1/1 ..	5458 ,,	+298 grams
,, ,, 1/3 ..	5473 ,,	+313 ,,
,, ,, 1/4 ..	5117 ,,	-43 ,,
,, ,, 1/5 ..	5295 ,,	+195 ,,
,, ,, 8/4 ..	4894 ,,	—266 ,,

Standard Error (S.E.) of 12 plots $\pm$ 87.2 grams. Difference = two-and-a-half times this (87.2 x 2.5 = 218) being significant, it is clear that Glasnevin Sonas—Victory II 1/1 and 1/3 were definitely superior and Glasnevin Sonas—

Victory II 8/4 definitely inferior in yielding capacity to Victory II, the control variety in this particular test.

Experiments carried out in subsequent years between Glasnevin Sonas—Victory II 1/1, 1/3, 1/4 and 1/5 showed that the stock bearing the number 1/3 was slightly superior to the others in grain yield and in resistance to lodging. Accordingly pedigree cultivations of Glasnevin Sonas—Victory II 1/3 were continued under the name of Glasnevin Ardri.

In subsequent years Glasnevin Ardri was submitted to a series of quantitative tests in small scale experimental plots with leading commercial varieties on the Albert Agricultural College farm. The results of these experiments are set out in the following Tables.

COMPARISON BETWEEN GLASNEVIN ARDRI AND GLASNEVIN SONAS

Year	A Glasnevin Ardri	B Glasnevin Sonas	Difference (A—B) with S.E.
1933	4440 grams	3470 grams	970 grams ± 110 grams

COMPARISON BETWEEN GLASNEVIN ARDRI AND ELDER.

Year	A Glasnevin Ardri	B Elder	Difference (A—B) with S.E.
1933	4440 grams	3527 grams	913 grams ± 110 grams

COMPARISON BETWEEN GLASNEVIN ARDRI AND ONWARD.

Year	A Glasnevin Ardri	B Onward	Difference (A—B) with S.E.
1938	5399 grams	4505 grams	894 grams ± 143.5 grams

COMPARISON BETWEEN GLASNEVIN ARDRI AND BINDER.

Year	A Glasnevin Ardri	B Binder	Difference (A—B) with S.E.
1937	3945 grams	4131 grams	—186 grams ± 122.4 grams
1938	5124 ,,	4440 ,,	684 ,, ± 135 ,,
1939	5734 ,,	5247 ,,	487 ,, ± 206 ,,

COMPARISON BETWEEN GLASNEVIN ARDRI AND EAGLE.

Year	A Glasnevin Ardri	B Eagle	Difference (A—B) with S.E.
1937	3945 grams	3847 grams	98 grams ± 122.4 grams
1938	5124 „	3235 „	1889 „ ± 135 „

COMPARISON BETWEEN GLASNEVIN ARDRI AND GLASNEVIN SUCCESS 10.

Year	A Glasnevin Ardri	B Glasnevin Success 10	Difference (A—B) with S.E.
1935	5104 grams	5313 grams	—209 grams ± 43.8 grams
1937	4059 „	3945 „	114 „ ± 122.4 „
1938	5124 „	5020 „	104 „ ± 135 „
1939	5734 „	5990 „	—256 „ ± 206 „

It will be seen from the above Tables that with the single exception of Glasnevin Success 10, Ardri compared well in yielding capacity with the other varieties against which it was tested. It must be borne in mind however that quantitative tests can at best only have application to the particular soil and weather conditions under which they were conducted. Special care must be exercised in interpreting the results from small experimental plots as the sowing condition, the quantity of seed sown, the subsequent treatment of the plots, and so on, cannot approximate as closely as is desirable to the conditions which obtain when oats are grown in the open field using the ordinary sowing, tilling, harvesting and threshing implements. Moreover certain varieties, especially those which are slow starters. do not appear to have the ability to show their real yielding capacity in small plots. This applies particularly to Glasnevin Sonas which has never done itself justice in these small trials. It will be seen therefore that small scale experiments while being useful to the plant breeder in enabling him to pick out the superior strains among his selections and hybrids are no substitute for large scale field experiments under ordinary farm conditions.

Glasnevin Ardri has through the co-operation of the Department of Agriculture been included in the oat variety quantitative experiments conducted annually by the Agricultural Instructors during the years 1934-1939 inclusive. The detailed results of each year's experiments from 1934 to 1938 have been published in the Department's Journal and are summarised in the following Tables.

1934.

Variety	Average Weight of Grain per Statute Acre		Average Weight of Straw per Statute Acre	
	cwts.	qrs.	cwts.	qrs.
Glasnevin Ardri	25	0	35	2
Glasnevin Sonas	25	1	35	2
Sonas Marvellous ..	24	3	35	3

20 centres

1935.

SERIES 1. HEAVY SOILS.

Variety	Average Weight of Grain per Statute Acre		Average Weight of Straw per Statute Acre	
	cwts.	qrs.	cwts.	qrs.
Glasnevin Ardri	27	1	39	2
Glasnevin Sonas	28	0	39	2
Sonas Marvellous ..	27	1	39	3

Grain 17 centres
Straw 13 ,,

SERIES 2. LIGHTER SOILS.

Variety	Average Weight of Grain per Statute Acre		Average Weight of Straw per Statute Acre	
	cwts.	qrs.	cwts.	qrs.
Glasnevin Ardri	26	3	39	1
Glasnevin Success ..	26	3	36	3
Victory II	25	2	38	3

Grain 38 centres
Straw 35 ,,

1936.

Variety	Average Weight of Grain per Statute Acre		Average Weight of Straw per Statute Acre	
	cwts.	qrs.	cwts.	qrs.
Glasnevin Ardri	25	0	37	1
Glasnevin Success ..	23	0	33	2
Victory II	22	2	34	3

49 centres grain and straw

Sonas Marvellous was included with the above varieties at 19 centres. It proved to be inferior in yields of grain and straw to Glasnevin Ardri but superior to the other two varieties.

1937.

Variety	Average Weight of Grain per Statute Acre	
	cwts.	qrs.
Glasnevin Ardri	27	0
Sonas Marvellous	25	3
Glasnevin Success	24	2
Victory II	24	1

16 centres

Series 2.

Variety	Average Weight of Grain per Statute Acre	
	cwts.	qrs.
Glasnevin Ardri	24	0
Glasnevin Success	23	1
Victory II	20	1

10 centres

1938.

Variety	Average Weight of Grain per Statute Acre	
	cwts.	qrs.
Glasnevin Ardri	25	0
Glasnevin Success	23	3
Victory II	23	0

52 centres

1939.

Variety	Average Weight of Grain per Statute Acre	
	cwts.	qrs.
Glasnevin Ardri	22	1
Victory II	20	2

66 centres

These experiments show that Glasnevin Ardri is capable of giving satisfactory returns when grown under a wide range of soil and weather conditions. On rich heavy soils Glasnevin Sonas appears to be superior in yield of grain but the latter variety is not equal to Glasnevin Ardri in its suitability for general cultivation. Moreover Glasnevin Sonas, being a very late maturing type, must be sown early.

Reports from Agricultural Instructors in connection with these trials show that Glasnevin Ardri is outstanding in regard to lodging resistance capacity. No plots of this variety were seriously lodged during the years 1934-1937 inclusive. In 1937 oat crops throughout the country were particularly heavy and as the harvest was wet many crops were badly laid that year. In the oat quantitative trials however at all centres Glasnevin Ardri stood up perfectly although the average yield reached the remarkable figure of 27 cwts. of dressed grain per statute acre. It is on record that at two centres in that year grain yields of over 2 tons per statute acre from Glasnevin Ardri were obtained and even there no lodging occurred. In 1938 however it lodged seriously at seven centres and less severely in thirteen other centres but on the other hand Victory II, grown in contiguous plots and carrying on the average a much lighter grain crop, lodged badly at sixteen centres and less seriously at twenty-four other centres.

In habit of growth, in development and in the external botanical characters of the young growing plant, Glasnevin Ardri closely resembles Victory II. As soon as the seedlings come overground there is rapid growth and plentiful tiller formation. Tiller counts taken in May over several years show that Glasnevin Ardri compares well with other varieties of spring oats in this respect. The proportion of these tillers which proceed to the formation of flowering shoots and ears is however lower than might have been expected. Ear counts taken during the harvesting of the 1938 small scale experimental plots have given the following results :—

Variety	Total No. of Ears 6 Plots	Average Weight of Grain per Ear
Glasnevin Success No. 10	2612	1.92 grams
" " No. 16	2545	1.96 "
Binder	2532	1.75 "
Glasnevin Ardri	2269	2.26 "
Eagle	2256	1.43 "
Sonas Marvellous	2001	2.18 "

Subsequent to the period of development known as the ' shooting stage, the remaining stages, *viz.* :—ear exsertion, flowering and eventually ripening take place respectively about one day later than Victory II, and approximately five days earlier than Glasnevin Sonas.

(Received for publication on 26th January, 1940.)

THE AGRICULTURAL COLLEGE, MOUNTBELLEW.

By a Member of the College Staff.

Prior to 1904, the educational facilities provided by the Franciscan Brothers at Mountbellew comprised secondary education for resident students as well as for day pupils from the district, and a special preparatory class for the Entrance Examination of the Training College for Teachers. Early in 1903 it was suggested that the Brothers should include the subject of Agriculture in the curriculum. There were, however, several difficulties in the way of this step. The subject could not be fitted in with existing programmes; no private or religious institution had so far engaged in this work and it seemed doubtful whether it could be carried on efficiently in conjunction with the other obligations of the Community; the farm attached to the College was small and the farm buildings and laboratory accommodation were inadequate.

These initial problems, however, were gradually solved. In the first place, the competent ecclesiastical authority not only sanctioned the change, either immediate or gradual, from general to agricultural education, but strongly urged and encouraged the Brothers to proceed with the project. To his mind there was such an urgent need for education of this kind in an agricultural country that he offered to defray out of his private resources the cost of a three years' course of training for three of the Brothers at the Agricultural Institute in Beauvais. Then Sir Henry Grattan Bellew, to the generosity of whose ancestors the Monastery owed its foundation in 1818, intervened, with the traditional kindness of the Bellew family, by offering at once additional land to meet initial requirements with the promise of more land as the Agricultural Scheme developed. When the Department of Agriculture were made aware of the Brothers' willingness to engage in the teaching of Agriculture, they generously made provision for buildings and equipment and offered to provide Scholarships, total or partial, for the students as occasion required and to provide for the training of Agricultural Teachers at the Albert Agricultural College, Glasnevin, and the College of Science, Dublin. This latter offer was accepted, and as a result three Brothers proceeded to Dublin for training.

The buildings were commenced without delay, and were ready for a first group of pupils in the Autumn of 1904. Mr. T. Hallissy, B.A., A.R.C.Sc.I., took charge of the first class but in the following year he was appointed to the Geological Survey, and his place was taken by Mr. Duncan Davidson

A VIEW OF MOUNTBELLEW COLLEGE.

other Associate of the College of Science. In 1906, two of the Brothers mpleted their training in Dublin and were available to take charge of tions of the work. By this time considerable progress had been made. e fruit and vegetable gardens and the students' horticultural plots had en laid out under the Department's direction. The latter have since ved as a model for the district and were very soon after adopted as a del by another Department. A group of twenty fruit plots had also laid down in the neighbourhood and these are still being operated the Mountbellew Fruit Growers' Association.

t had been hoped by all concerned that the pupils for the Agricultural rse would come mainly from the surrounding district. At the start, ed, only three of the pupils were resident and the remainder were day pils. Although the Department defrayed the cost of transport for the y pupils coming from a distance it soon became evident that the numbers these day pupils could not be maintained in this way and that it would be cessary to concentrate for the time being on residential students, while oviding for as many day-pupils as availed of the course, and to await further opportunities of impressing on the neighbourhood the advantages of agricultural education. During the 1907 session there were twenty-six resident pupils, who came from Cork, Derry, Donegal, Dublin, Galway, ilkenny, Limerick, Mayo, Meath, Roscommon, Sligo and Tipperary. Since then all counties have been represented in the lists of pupils. The general educational facilities provided by the College were continued for a few years after instruction in agriculture was initiated but were then terminated as it had become evident that the energies of the whole staff were required for the effective teaching of Agriculture.

The first important opportunity of arousing local interest in agricultural education was the establishment of the Mountbellew Agricultural Show, in which the College staff collaborated with Sir Henry Grattan Bellew and others. The President of the College took the opportunity of visiting every village in the district and of holding small meetings for the purpose of explaining the advantages of the Show. The Shows of 1904 and 1905 were held in the College Grounds but it was soon apparent that it would be necessary to have more space for the exhibits, which even in those years numbered well over a thousand. Sir Henry Grattan Bellew provided the present extensive grounds where the Show has been held annually for over thirty years. Since its inception the Show has been instrumental in achieving the gradual education of the small farmer, as evinced by the steady improvement of the live-stock, farm produce and home industries exhibits; and it has constituted an important social and educational event for the youth of the district. In addition to the farmers' exhibits and those illustrative of home industries, exhibits have been staged by the Agricultural Instructors on the subjects of agriculture, horticulture, dairying and poultry-keeping.

THE FARMERS' CLUB.

When the work of the College had become exclusively agricultural Farmers' Club was started and for some years series of weekly lectu were provided which were attended by the local farmers in large numb and greatly appreciated. The aim of the lectures was to give inst tion in straightforward, non-technical language on practical matters affec farmers' everyday work. The first lecture was given in the Village and the subject selected was "Seeds other than Hayseed." It was assu that the farmers and shopkeepers who were present and who had handling seeds all their lives would have no difficulty in identifying seeds placed before each in separate lots, or at least in ruling out th they would not sell in their shops or sow on their land. Only one or tw those present attempted to name a few of the eighteen samples, and th guesses were mostly incorrect. After this test it was generally agreed l the farmers that further instruction in regard to seeds was necessary. series of lectures on seeds was then arranged at the College Hall and at termination the farmers had learned how to evaluate, purchase and mix seed how to carry out simple germination tests and to detect weeds. Henceforth they were prepared to admit that even successful farmers might have something to learn about the practice of farming.

This was followed by a well-planned course of lectures in the College H. on manures, feeding stuffs, live-stock and their treatment (including first-aid to sick animals) and the crops of field and garden. The lectures were illustrated by simple experiments and, as occasion demanded, by lantern slid Subsequently the lecturer organised calf-feeding and manurial experime and competitions which were carried out on the home farms, the soils o which were tested for lime content. Feeding stuffs and manures were secure for the farmers on the most advantageous terms. In connection with the competitions valuable prizes in cash and kind, including farm implements were offered. An extern judge was engaged for a fortnight in visiting the farms and deciding on the prize-winners. The calves and produc were also entered for the Mountbellew Show, in separate classes set apart for members of the Farmers' Club. The calf-feeding experiment had as objective to show the value of crushed oats as a calf food in preference to the expensive patent calf meals which were then on the market. The competitions were divided into five classes each comprising five calves which were weighed at intervals over six months or more, and fed on five different foods of which crushed oats was one. Any prejudice against the use of crushed oats was overcome when at the Mountbellew Show the calves fed on crushed oats were awarded the first prize.

HOME IMPROVEMENT SCHEME.

At a later time a Home Improvement Scheme was organised by the College in which about a hundred homesteads took part, a fee of five shillings being

charged for each entry. The scheme comprised a competition for three classes, *i.e.*, (1) Slated houses with their farms ; (2) Thatched houses with their farms ; and (3) Cottages with plots attached. For each of these classes money prizes and prizes in kind were offered. Two inspections took place under the Scheme. The first was made in the autumn, when the judge gave advice to the competitors regarding improvements under consideration and pointed out where improvement was necessary. Each competitor was supplied with a booklet showing such headings as :—(*a*) The Home from Within ; (*b*) The Home from Without ; (*c*) The Home Surroundings ; (*d*) Sanitation of the Home. Marks were allotted under each of these headings which enabled the judge at the second inspection to estimate the improvements made during the intervening months. Only those marks given at the final inspection counted towards prizes. Every competitor was required to enter exhibits at the Mountbellew Show and the awards were announced conjointly with those of the Show. Visitors to the district in those days were impressed by the wonderful transformation effected by the people themselves in the neatness of their homes, gardens, farms and general surroundings, and the enthusiasm and friendly rivalry then started is still in evidence. Young and old worked with zeal to make the Scheme a success.

WHEAT.

One of the distinctive features of the district for over a quarter of a century has been the growing of wheat. For many years previously wheat-growing had practically died out in the district and its re-introduction may truly be said to be largely due to special lectures provided at the College. At one such lecture over a hundred farmers attended. Before each was placed a plate of buttered whole-meal bread and no reference was made to it till the end of the lecture. The task before the farmers was to estimate the cost of everything done and everything bought from the ploughing of the land for the wheat until the wholemeal therefrom reached the kitchen. Each item of the cost was discussed at some length and, when agreed on, was written on a blackboard after which the total cost was calculated, the yield of grain being taken at an average of one ton per acre. The price per stone of wholemeal worked out at one shilling and six pence, all costs included. The farmers were then invited to taste and test for themselves the bread before them, made from wholemeal ground from home-grown wheat in the College Mill. A verdict of approval was given and little persuasion was needed to get each farmer to sow a half-acre of wheat that season. The College undertook to devote two days each week in the autumn to grinding a small lot of wheat for each farmer. Later on, the present Mountbellew Mill was erected and took over this work for the farmers as well as many other activities, of which the principal one continues to be the preparation of feeding stuffs for the people of the district from their own corn crops.

DAILY ROUTINE.

A typical day at the College begins for the students at seven o'clock in the morning, except for the group whose turn it is to go out at six o'clock to the farm yard. After dressing, morning prayers and Mass, the students breakfast at eight o'clock following which there is a short interval of leisure till nine o'clock. Then one division engages in indoor work in the class-room or laboratory and the other in outdoor seasonal work in such manner that each pupil takes his turn at the work which is proceeding in field, garden, poultry run, dairy and feeding house. At noon all assemble for lunch, after which the duties of the two divisions are reversed until dinner time at three o'clock, Then follows recreation until five o'clock when study begins, except for the group which goes in turn to the wood-work class. After tea at 7.15 p.m. there is an interval until eight o'clock when another hour of general study follows before night prayers are said and the students retire to their dormitories.

On Sundays after the lecture by the resident chaplain, students have some free hours for walks. In the evening, as well as every week evening during Lent, May and October, the students attend Rosary and Benediction.

FARM WORK.

The opportunites for acquiring a sound knowledge of practical, scienti' farming are numerous and are suited to all types of young farmers wh come to Mountbellew, whether from large or small farms. Students ta part in all seasonal operations, such as the care and feeding of cattle, sheep, pigs, horses and poultry, the management of field and garden crops, the improvement of pasture and the reclamation of land, and in the stock-feeding and manurial experiments carried out from time to time.

The farm consists of one hundred and seventy statute acres, including about forty acres of rough woodland grazing. Approximately one-third of the remainder is under a five-course rotation. The crops grown are wheat, oats, potatoes and roots including sugar beet.

The College maintains a herd of twenty Shorthorn cows which has been graded up in recent years so that a foundation has been laid for a pedigree tuberculin-tested herd. Some of the non-pedigree as well as the pedigree cows on the Register yield annually between nine hundred and a thousand gallons of milk. All records are carefully kept and tests for butter fat are made at regular intervals.

A small flock of Oxford Down sheep is kept. Galway ewes are crossed with the Oxford Down and the lambs are sold fat in April and May.

STUDENTS' HORTICULTURAL PLOTS, RECREATION GROUNDS AND BALL COURT.

The herd of Large White pigs has a long established reputation. Prizes are frequently obtained at the Royal Dublin Society's Shows and Sales, at Limerick and at other County Shows. The best of the young boars and sows are kept for breeding and the rest are sold to the factory, where they generally qualify for the highest grade. Large numbers of pedigree boars are sold to premium holders.

The best breeds of poultry are kept and students take part in the various operations connected with their successful management. Large numbers of cockerels are sent out to Poultry Stations, and settings of eggs are despatched to various districts. Prizes have been secured at the National Egg-laying Tests at the Munster Institute, the latest being first prize in Section 3 of the 1938-39 Test.

About two acres are devoted to the more useful varieties of apples and small fruit. Besides helping in the cultivation of the vegetable garden each student is provided with a horticultural plot in which he raises the common garden vegetables.

Students are also instructed in Bee-keeping and the various operations connected therewith.

INDOOR WORK.

The syllabus of instruction has had for its object from the start the co-ordination of class-room work with the practical work of the farm. The Department of Agriculture laid down only broad outlines and encouraged the Brothers to build up the present comprehensive programme as their experience suggested.

For a considerable time the Brothers found it necessary to extend the primary education of some pupils, in order to enable them to derive greater profit from the course of agricultural instruction. Such work was generally well worth while, and enabled many pupils who entered the College with only a limited education to become sound practical farmers. In later years the standard of education of the pupils on entrance has been more satisfactory. Some have received a secondary education before admission to the College and this has been of advantage to them in the prosecution of their agricultural studies. Good results have been achieved by students from good primary schools who have a practical bent, especially if they have attended a course of Winter Agricultural Lectures in their district. County Scholarships in Agriculture are now offered annually by all County Committees of Agriculture and boys are selected by competitive examination for a course of agriculture such as that given at Mountbellew. Such boys are generally among the more successful students. In 1912, when only a few such scholar-

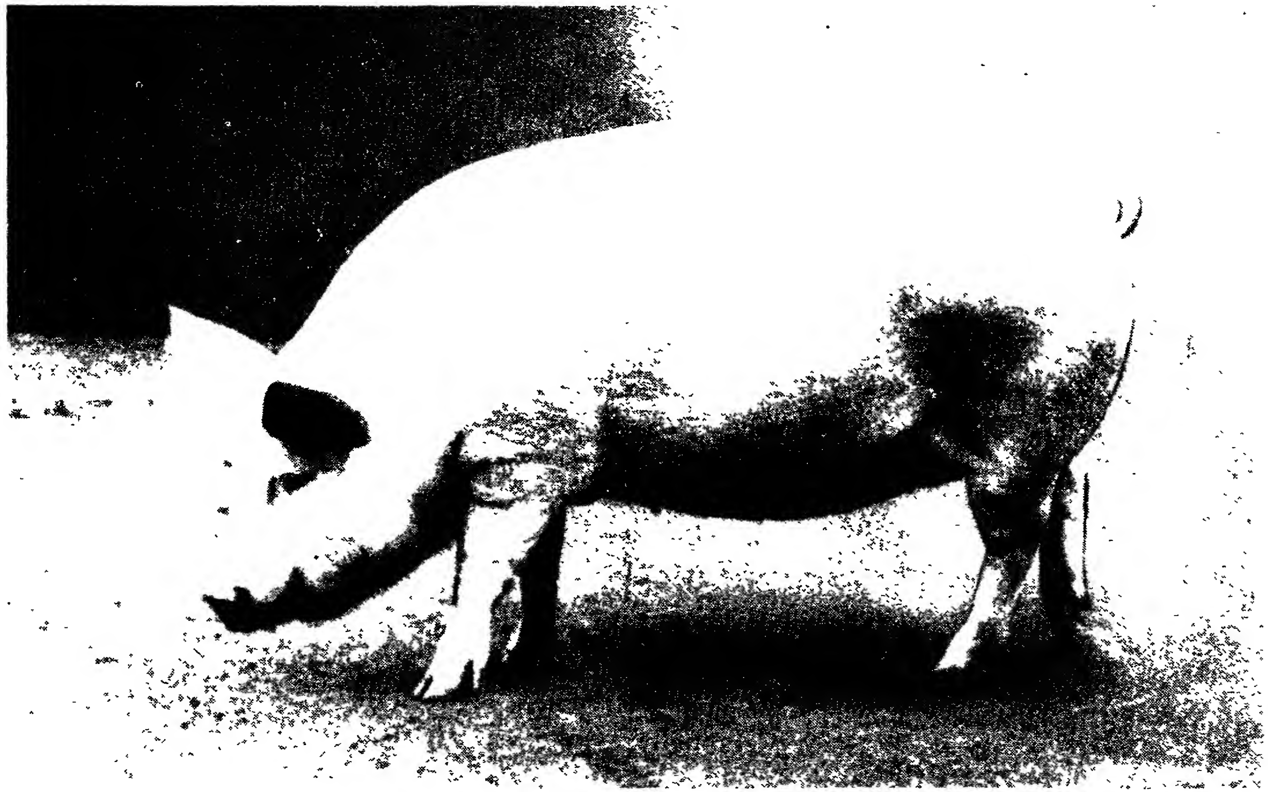
ships were offered by some counties in the South, a pamphlet was circulated from the College to every County Committee in the country, advocating that a portion of the monies contributed by farmers to County funds should be set aside to promote the agricultural education of farmers' sons. The brochure proved to have a stimulating effect in securing scholarships for the farming community. It was welcomed generally by the Committees, more copies were asked for, and the supply was soon exhausted.

The indoor work includes instruction in Agriculture and the related sciences, farm costings, woodwork and farm accounts. In the early years a scheme of farm-account keeping was initiated at the College and this is now in general use. Some of the subjects, such as chain-surveying, mapping, and the identification of plants, necessitate field work as well. The lectures are illustrated by a series of laboratory experiments, but it is stressed at all stages of the course that the most comprehensive experiment is the practical application of principles in the daily work on the farm.

Lectures are given on rocks and soils, the various classes of manures, farm and garden crops, feeding stuffs, live stock and their management, including first-aid to sick animals, and Chemistry and Botany in relation to Agriculture. Students keep records of the lectures and experiments.

Special books are kept in which specimens of the useful and inferior grasses are preserved as well as the weeds and common plants of the district. Plants are identified in their habitats, collected and dried. By the time the student has dried, mounted and labelled them with their popular Irish and English names, he has a good knowledge of the local flora, as exemplified by the specimens collected and has little trouble in identifying the weeds of his own district.

Over eight hundred young farmers have completed the course at Mountbellew since 1904. The average number has been thirty per year for the past ten years. With comparatively few exceptions all past pupils have continued to be connected with agriculture in some form. A considerable number secured employment under the various Departmental and County Schemes. Others are engaged as Stewards or Farm Managers in Institutions, or are employed in Creamery work, Horticultural work or Forestry. A few have continued their agricultural studies at the College of Science, Dublin, and more recently at the National University. A large proportion have returned to their home farms. Naturally a student profits by the course in proportion to the extent of his general educational groundwork. In recent years some pupils have acquired a Secondary School Leaving Certificate before admission to the College. These generally aim at securing one of the Department's or County Scholarships to the University, either direct from Mountbellew or after a further year at the Albert Agricultural College, Dublin. Several of the counties now offer to their scholars



Courtesy] MOUNTBELLEW QUEEN 68. [*Irish Times*

Winner of Challenge Cup for best Large White Sow, Royal Dublin Society's Spring Show, 1940.

a further year's scholarship at the Albert College, and many of the Scholars at Mountbellew enter for this extended course.

From the beginning the College and its work have been under the supervision of the Department of Agriculture and subject to its inspection. Entrance and terminal examinations are conducted by the Department's Inspectors.

A SURVEY of the APHIS POPULATION OF POTATO CROPS IN IRELAND in relation to THE PRODUCTION OF SEED POTATOES.

By

James B. Loughnane, M.Sc., B.Agr.Sc.,
Department of Plant Pathology,
Albert Agricultural College, Glasnevin, Dublin.

INTRODUCTION.

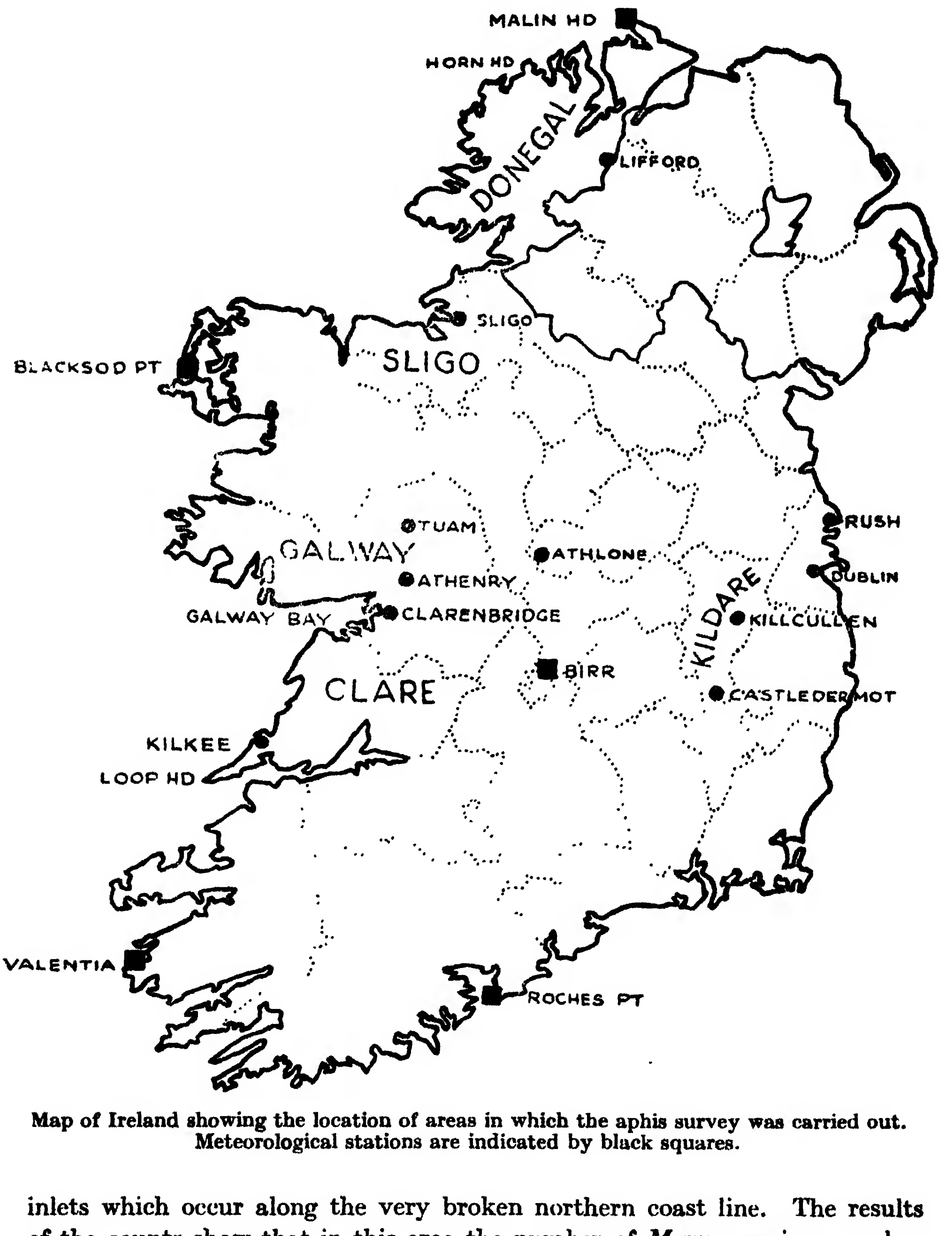
It is now generally accepted that the degeneration of potato stocks is mainly due to the infiltration of virus diseases and that some at least of these diseases are transmissible by certain aphis species. As far as is known at present the species which possesses the greatest power of transmitting potato viruses is the aphis *Myzus persicae* since this insect has been shown to be an efficient vector of at least three important potato viruses, namely leaf roll, virus Y (leaf drop) and virus A (mottle). Consequently it is safe to say that areas in which this species occurs in large numbers are unsuitable for the maintenance of virus-free potato stocks. As is now well known *Myzus persicae* does not occur to the same extent in all areas, its distribution being dependent on a number of factors some of which are established. The present survey was carried out during 1938 and 1939 with the object of ascertaining the aphis population of potato crops in some of the seed-producing areas in Ireland. The aphis counts were made in seed-producing areas in Counties Donegal, Sligo, Galway, Clare, Westmeath, Dublin and Kildare. Separate examinations were made in early June, mid-July and mid-August. The object of the June count was to ascertain the approximate date of the initial infestation, that of the July count to ascertain the maximum numbers of aphids likely to be present as it was considered that the maximum population would be reached at this time. It was anticipated that the August count would cover the possibility of a late outbreak in any of the areas.

The method adopted in making the counts was as follows :—as the crop being examined was traversed along its diagonals plants were selected at random and the numbers of insects present on five or six leaves of each plant were noted, the leaves being taken at different positions on the plants. Thus in each crop no fixed number of leaves was examined, the number varying with the size of the crop.

The results of the counts are shown in Table I. The numbers of the four most common potato-feeding aphis species are recorded separately and the numbers of winged and wingless forms are shown under each species.

Description of Areas and Results of Counts.

The area in which counts were made in Donegal (see map) was mainly north of a line from Horn Head to Lifford. The majority of the crops examined were at low altitudes and close to one or other of the numerous



Map of Ireland showing the location of areas in which the aphis survey was carried out. Meteorological stations are indicated by black squares.

inlets which occur along the very broken northern coast line. The results of the counts show that in this area the number of *Myzus persicae* was less than one per 100 leaves at the time at which the examinations were made. The numbers of other species recorded were negligible.

In County Sligo the area in which counts were made was within 2 miles of the Atlantic and extended from about 10 miles north of Sligo to about 5 miles south-west of the town. Most of the crops were in open exposed situations and were about 80 feet above sea level. It was found that the population of all species recorded in this area in July and August, 1938 and June and July, 1939, was negligible.

The crops examined in County Galway were all within ten miles east of a line from Tuam to Athenry and extending to Clarenbridge. This area might be regarded as an inland one as its west side is about fifteen miles from Galway Bay. The crops in this area were at low altitudes and in exposed situations. The aphis counts revealed negligible numbers of all species in 1938 and this was true of the June and July counts in 1939. In August, 1939 however, there was a marked increase in the population of *M. persicae* which amounted to 26.9 aphids per 100 leaves. The reasons for this increase will be discussed later.

In County Clare the greater portion of the area in which crops were examined is situated on the Loop Head peninsula, and the remainder about five miles east of Kilkee and about the same distance from the sea. The crops were mainly close to the sea and at low altitudes. The area is very exposed, wind-swept and treeless. Here again the numbers of aphids of all species recorded on the potato crops examined were negligible except in August, 1939, when *M. persicae* rose from 1.2 in July to 14.0 per 100 leaves in August.

The Athlone area is for the most part low, boggy and exposed although since the fields are small, individual crops are sheltered. Counts were made in this area in July and August, 1939, only. In July the numbers of all aphis species were negligible, but here again as in Clare and Galway, there was a marked increase in the aphis population in August, *M. persicae* increasing from 2.0 in July to 37.6 per 100 leaves in August.

Counts were made also in the eastern part of the country in the counties Kildare and Dublin. These were made in May and August, 1938 and in June and July, 1939. The results here go to show that there is no very appreciable difference between the populations of *M. persicae* on potato crops in the eastern part of the country and on those in the west, when such crops are grown under ordinary farm conditions. A count made on 24th May, 1938, in Kildare revealed that winged *M. persicae* were active on this date as 19 winged and 10 wingless forms were counted on 700 leaves. No further counts were made in this area until 30th August, 1938, when 16 *M. persicae* were counted on 600 leaves. On 3rd July, 1939, 300 leaves were examined in three crops between Kilcullen and Castledermot in Co. Kildare, and six wingless *M. persicae* were counted.

In County Dublin counts were made on 6th June, 1939, in a small district

around Rush which is the centre of a market-garden area situated beside the Irish Sea and about fifteen miles north of Dublin City. This is not a seed potato producing district, the cultivation of potatoes being confined mainly to early varieties for the Dublin market. Here five separate crops were visited and 100 leaves examined in each crop. A total of 27 *M. persicae* was counted. The potato foliage was at this time tending to yellow and ripen off and it is possible that the aphis population was higher in this area at an earlier date, although there was no evidence in the crop to support this.

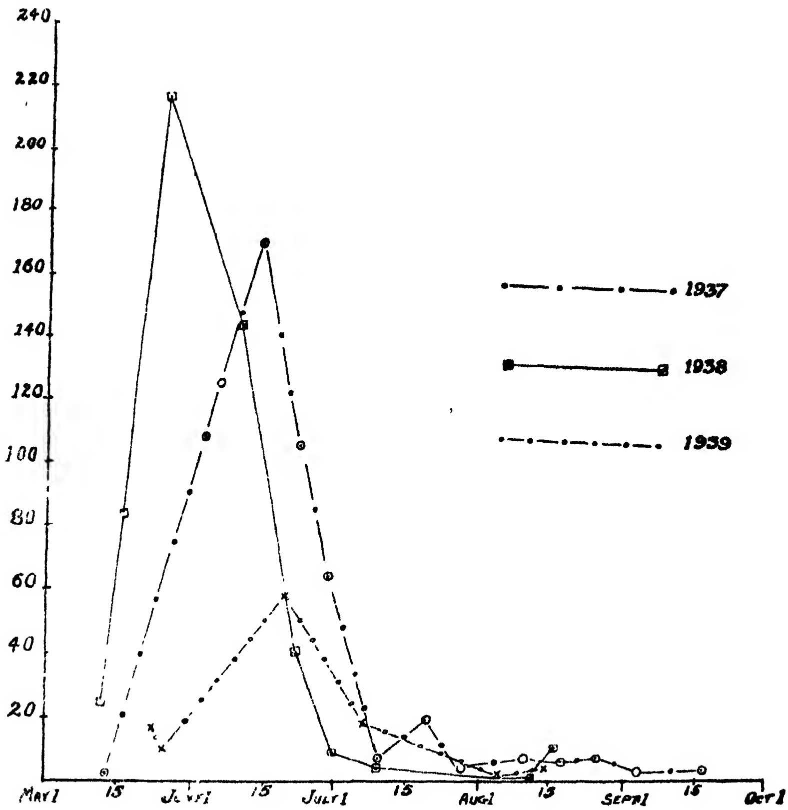


FIG. 1.
Graphs showing the population of *M. persicae* per 100 leaves on potato plots at the Albert Agricultural College, Glasnevin, during the years 1937, 1938 and 1939.

A centre which would represent an urban area unsuitable for the production of seed potatoes, since virus diseases are known to spread rapidly in it, is the Albert Agricultural College, Glasnevin. Here during 1937, 1938 and 1939 the potato plots in which counts were made have been situated adjacent to a market garden in which winter and spring cabbages have been grown each year. The plots were in a sheltered position of low elevation. Counts were made on these plots during the growing seasons of 1937, 1938, 1939 and the results are expressed in graphical form (Fig. 1). It is noticeable

that at this centre *M. persicae* is generally found on the potato plants shortly after they come above ground, that is, about the middle of May. The numbers then increase rapidly so that maximum numbers generally occur about the latter half of June. This is shown in the years 1937 and 1939 and was noticed in a few preceding years also. In 1938, however, the maximum occurred earlier, that is, in the last week of May, and the numbers then decreased rapidly. This early and heavy infestation in 1938 was responsible for a considerable spread of leaf roll in the virus plots at Glasnevin in that year, there being an increase in spread of 60 per cent. over the year 1937. In 1939 the maximum number of *M. persicae* was not high being only 60 individuals per 100 leaves as compared with 170 in 1937 and 218 in 1938. The reduction in initial infestation in 1939 is attributed to heavy frost in December, 1938. The rapid reduction in numbers of *M. persicae* so early in the season is due to attacks by hymenopterous parasites which begin generally about the first week in June, although in 1939 the attack was very much later.

It is apparent from the preceding that *M. persicae* occurred in very small numbers during 1938 and 1939 in potato crops in the seed-producing districts in the west of Ireland and in fact, with the exception of small outbreaks in August, 1939, in Galway, Athlone and Clare, the numbers could be regarded as negligible. These late outbreaks referred to could have arisen from reproduction of the individuals already in the crops, or it is possible that there may have been a small infestation by winged forms late in the season from some other host. It is not considered that late outbreaks such as these are of great importance from the point of view of disease transmission, as plants are not so susceptible to infection when beginning to mature as they are earlier when they are succulent and growing rapidly. Furthermore spread of virus diseases would be confined to transmission within the crop since the majority of the aphids present are wingless forms.

Regarding the prevalence of other species of potato-feeding aphids it will be noticed that *Macrosiphum gei* Koch. was recorded at all the centres visited and here again the numbers showed an increase in August, 1939, in Clare and Athlone, but the numbers amounted to only 14.2 and 12.3 per 100 leaves respectively. At other centres the numbers of this species recorded were of negligible proportions.

Myzus pseudosolani Theo., another potato-feeding species, was recorded at all centres but here again in insignificant numbers since it did not exceed two individuals per 100 leaves in any of the counts. The alternate food plant of this aphis is said to be the foxglove (*Digitalis*) (10). This plant was examined on a number of occasions in Co. Donegal without revealing the presence of any *M. pseudosolani.*

A fourth aphis species which ordinarily feeds on potatoes and which was recorded during the present survey is *Aphis rhamni.* Boyer. This species

appears to have a somewhat uneven distribution since it was not recorded in Donegal or at Glasnevin in 1938 or 1939. It is a species which generally does not appear in any quantity on potatoes in Ireland until about August. In August, 1939, there was a severe outbreak of this species in the Athlone area the figure of 130 per hundred leaves being recorded, the under surface of some of the leaves examined being almost covered by the insects. This species forms large colonies which do not readily disperse. There was also a minor outbreak of this species in August, 1939, in Clare, the figure of 18 per hundred leaves being reached.

The only other species recorded which would be regarded as a potato-feeding one was *Aphis rumicis* Linn. It was, however, recorded on only a couple of occasions and then in insignificant numbers.

Where potatoes were grown in proximity to sycamore trees, the aphis *Drepanosiphum platanoides* Sch. was frequently recorded on the former host, In all cases the individuals found were alate forms and many of them appeared to be feeding. These, however, were regarded as vagrants and are not included in the table.

Factors influencing the prevalence of Myzus persicae.

As previously stated *M. persicae* is regarded as the most important aphis species from the point of view of potato virus transmission and areas in which it occurs in abundance are classified as unsuitable for the production of virus-free seed potatoes.

Of the factors which influence the prevalence of this insect, the most important is the presence or absence of suitable food plants.

Like most aphis species, *M. persicae* requires a summer and a winter host on which to complete its life history. Its summer host range is a very wide one and comprises the majority of succulent plants, including the potato on which it reproduces parthenogenetically. In autumn winged forms are produced which migrate to the winter host, namely the peach tree, and on this host sexual forms are produced. This host does not occur in Ireland except under glass. The females deposit fertilised eggs and it is by this means that the species survives the winter. On hatching in spring the eggs give rise to wingless females which reproduce parthenogenetically giving rise to winged migrants and these fly to the summer hosts.

It was shown, however, by Davies (3) in Wales that under winter conditions there, sexual forms of *M. persicae* are not found, but that the insects migrate to and continue to reproduce slowly throughout the winter on plants of the brassica tribe, mainly cabbages. This author has also pointed out that the aphids appear to survive best on the Savoy variety as they appear to be held in the pockets formed by the puckering of the leaves. In spring repro-

duction of the aphids is accelerated, winged forms are produced in abundance and these migrate from the cabbage to summer hosts including the potato. It is evident, therefore, that potatoes grown in the vicinity of extensive market garden areas where large quantities of winter cabbages are produced would become heavily infested with *M. persicae* in spring, any virus diseases present in the crop being thus spread.

There are, however, certain atmospheric conditions which appear to exert an influence on the flight and general activity of these winged forms. It has been concluded from laboratory experiments (4, 5) that the combination of conditions which favour flight is a temperature above 65°F, relative humidity of the atmosphere less than 70% and wind velocity below 5 m.p.h.

In connection with flight the distance which *M. persicae* may travel is of importance in connection with the isolation of potato stocks. Davies (6) has shown that isolated potato plants can be reached by winged migrants from a distance of at least a quarter of a mile and probably much further.

Bryan (1) in experiments on the maintenance of healthy stocks of potatoes in England found that infection of healthy stocks with leaf roll took place when the nearest leaf roll infected material was 250 yards away. He also states (1) on Salaman's authority that in Suffolk isolation of over a mile proved ineffective in preventing the infection of healthy stocks of potatoes with virus diseases.

Experiments in America (8) go to show that when thirty-one virus-free seedling strains of potatoes were planted at least half-a-mile from other potatoes and from soil that had never produced potatoes, infection with the veinbanding virus (Virus Y) occurred to an extent varying from 10 per cent in some strains to 100 per cent. in others. As regards the movement of species other than *M. persicae*, Patch (9) states that from the point of view of reducing the spread of virus diseases the slogan should be " a mile from the nearest rose bush." The rose bush is the overwintering host of the aphid *Macrosiphum gei* which in America is regarded as a vector of certain potato virus diseases. This presupposes that all infection must come from potatoes. The experiments of Salaman (13) suggest, however, that cabbage may act as a host of leaf roll and virus Y. There are records of winged aphids having been found several miles from their normal habitat, as for example on islands 36 miles away from the north sea coast of Germany and in Spitzbergen 800 miles away from the nearest host plant. In these cases, however, actual transportation by wind rather than voluntary flight must be regarded as the means by which such distances were covered.

Although aphids can travel, or be transported, over great distances, it must not be supposed that the isolation of potato stocks for the maintenance of health is completely ineffective. Its effectiveness will obviously be deter-

mined by the intensity of the population of insect vectors, mainly *M. persicae* in a particular district. Where such vectors are scarce or almost completely absent as in the seed-producing areas in the west of Ireland isolation of healthy stocks is likely to be completely effective and the practice followed in this country of isolation of 100 yards from the nearest potato crop or from ground keepers should give a very large measure of protection in our best districts. (See Table I). On the other hand in districts where *M. persicae* is abundant, effective isolation of healthy stocks is almost impossible of attainment, since 100 yards quite obviously falls considerably short of the necessary distance. The aim therefore should be to confine, as far as possible, the growing of healthy stocks to districts in which the population of *M. persicae* is known to be low and as a further safeguard, and this generally follows, to districts in which the general standard of health of the potato crop is high.

It is also necessary to consider the effects of the prevailing wind on the migration of aphids. Experiments in Germany (11) showed that in the case of *M. persicae* wind of even slight velocity influenced flight and with winds of 6 to 7 m.p.h. the windward side of boards covered with adhesive caught more aphids than the other. In America it has been shown (12) in work with the turnip aphis *Rhopalosiphum pseudobrassiçae* that when adhesive screens were erected on both the leeward and windward side of turnip crops, the number of aphids caught on the former in eight months was 2461.3, while the number on the windward side for the same period was 439.7. It would thus appear that the winged aphids arising within the turnip crop were, when in flight, carried by the force of the prevailing wind towards the leeward side of the crop and were caught on the adhesive screens there ; also that the wind retarded the movement of aphids in the opposite direction, namely towards the windward side, so that considerably fewer individuals were caught on the screens erected at that side. This suggests that the direction of the wind has a very marked effect on the direction of movement of the aphids, and as a consequence, the direction of virus spread should be that of the prevailing wind.

A factor which undoubtedly has an effect on aphis movement and which so far has not been investigated is that of light intensity. Although this factor is connected with those of temperature and humidity, it is, however, likely that in itself it has a controlling effect on the flight of aphids. The writer has frequently observed that if winged *M. persicae* in a glass vessel are kept in a shaded position, very little movement takes place, the aphids being rather sluggish. If the vessel is then moved into bright sunlight movement of the insects is considerably increased, the change being almost immediate.

Apart however, from the effects of external conditions on the movement of aphids, the writer is of opinion that in spring and early summer there

is a natural urge on the part of these insects to move about. As already stated, winged forms are produced in relatively large numbers and the function of these appears to be the distribution of the species so that intense activity in the spring is part of the life cycle.

Conditions in Ireland and their Effects on the Population of Myzus persicae.

Food Plants. As sexual forms of *M. persicae* do not appear to be produced under winter conditions in Ireland, it follows that the species must survive in the viviparous state and this has been found to be so. The writer has never found sexual forms of this species in the open. Consequently the prevalence of *M. persicae* in the spring will depend upon the abundance of suitable winter host plants, such as swedes, rape and cabbage. Under general farm practice in Ireland, however, swedes are pulled and removed from the land during late autumn or winter, so that this crop is not available as a winter host for the aphis. Rape as a field crop is not generally grown and in any case is generally fed off the land during winter and the remains ploughed in by the spring. The cultivation of winter cabbages on any large scale is confined to small market garden areas in the vicinity of the larger towns and the best seed-producing districts are well isolated from such areas. Consequently it may be said that suitable winter host plants for *M. persicae* are scarce in most areas and one would expect that this would indicate low aphis populations on potatoes in spring. That this is so will be apparent from the results of the counts made in different parts of the country, (see Table I).

Regarding the meteorological conditions which influence the movement of *M. persicae* and which have already been referred to, it may be said that over the greater part of Ireland but particularly along the western seaboard conditions appear to be unfavourable for movement. This is especially so in the case of relative humidity.

Table II (14) shows the average relative humidity at five meteorological stations in Ireland over a number of years. Readings taken at 13 hr. G.M.T.

This Table indicates that the relative humidity along the western seaboard is higher than that recorded in the centre of the country and that it is generally well above 70 per cent. which is the maximum for aphis flight.

Table III shows the number of days on which conditions suitable for flight occurred together at 13 hr. G.M.T. at certain meteorological stations in Ireland during April to September, 1938 and 1939, assuming these conditions to be wind force 2 (Beaufort), temperature above 55°F. and relative humidity below 70%. The figures are taken from the daily weather report of the Meteorological Office, London.

TABLE I.

Date 1	Area 2	Total crops examined 3	Total leaves examined 4	Total Aphids recorded 5	Total Myzus persicae 6	Myzus persicae per 100 leaves 7	Total Macrosiphum gei 8	Total Myzus pseudosolani 9	Total Aphis rhamni 10
1938. June	Donegal	12	1460	14	6/2	0.5	0/1	1/0	0
,, July	,,	9	1240	11	0	0	0	0/8	0
,, Aug.	,,	9	920	39	0/3	0.3	0/27	0/1	0
TOTAL ...		30	3620	64	6/5	0.3	0/28	1/9	0
1939. June	Donegal	7	1020	39	0/6	0.5	0/12	0	0
,, July	,,	13	1610	12	0/11	0.7	0/11	0/1	0
,, Aug.	,,	8	1530	47	0/2	0.1	3/9	0/24	0
TOTAL ...		28	4160	98	0/19	0.4	3/32	0/25	0
1938. June	Sligo ...	—	—	—	—	—	—	—	—
,, July	,, ...	6	680	14	0/2	0.3	0/9	1/2	0
,, Aug.	,, ...	6	650	31	0/9	1.4	0/13	1/2	0/3
TOTAL ...		12	1330	45	0/11	0.8	0/22	2/4	0/3
1939. June	Sligo ...	9	1050	44	0/11	1.0	2/20	0/6	0
,, July	,, ...	5	570	18	0/4	0.7	0/4	0/9	0
,, Aug.	,, ..	—	—	—	—	—	—	—	—
TOTAL ..		14	1620	62	0/15	0.9	2/24	0/15	0
1938. June	Galway ...	8	950	14	6/2	0.8	0	1/0	0
,, July	,, ...	9	1150	4	0/3	0.2	0/1	0	0
,, Aug	,, .	10	1060	36	0/11	1.0	0/7	0/3	0/2
TOTAL ...		27	3160	54	6/16	0.7	0/8	1/3	0/2
1939. June	Galway ..	5	950	26	0/2	0.2	0	2/12	0
,, July	,, ..	10	1800	23	0/9	0.5	0/3	0/3	0/15
,, Aug.	,, ..	7	740	309	10/180	26.9	0/21	0/2	0/50
TOTAL ...		22	3490	358	10/290	6.0	0/24	2/17	0/65
1938. June	Clare ...	9	1927	41	6/12	0.9	1/4	2/7	0
,, July	,, ...	21	4020	1	0	0	0/1	0	0
,, Aug	,, ...	10	1310	87	2/43	3.4	0/10	0/5	0/28
TOTAL ..		40	7257	129	8/55	0.8	1/15	2/12	0/28
1939. June	Clare ..	—	—	—	—	—	—	—	—
,, July	,, ...	9	1653	51	2/18	1.2	0/6	0/2	0/17
,, Aug	,, ..	11	1040	538	4/142	14.0	2/146	0/1	0/185
TOTAL .		20	2693	589	6/160	6.1	5/152	0/3	0/202
1939. June	Athlone .	—	—	—	—	—	—	—	—
,, July	,,	10	1180	58	0/24	2.0	0/20	1/0	0/6
,, Aug.	,, ..	12	1120	2044	0/422	37.6	0/138	0/10	0/1457
TOTAL ...		22	2300	2102	0/446	19.0	0/158	1/10	0/1463
1938. May	Kildare ..	5	700	39	19/10	4.1	2/3	0/3	0
,, Aug.	,, .	6	600	43	1/15	2.6	1/2	0	0/23
TOTAL .		11	1300	82	20/25	3.5	3/5	0/3	0/23
[illegible]39. July	Kildare ...	3	300	9	0/6	2.0	0/1	0/1	0/1
[illegible]OTAL ...		3	300	9	0/6	2.0	0/1	0/1	0/1
[illegible]39. June	Dublin ...	5	500	92	1/26	5.4	0/35	6/16	0/9
[illegible]AL ..		5	500	92	1/26	5.4	0/35	6/16	0/9
[illegible] May	A. A. College	1 (3 counts)	300	415	133/195	109.3	36/49	2/0	0
June	,, ,,	1 (2 ,,)	200	274	47/137	92.0	5/67	1/2	0
July	,, ,,	1 (3 ,,)	300	71	0/15	5.0	1/40	0/3	0
,, Aug.	,, ,,	1 (2 ,,)	220	44	0/10	4.5	1/25	0/3	0
TOTAL ...		1 (10 counts)	1020	804	180/357	52.5	43/181	3/8	0
[illegible]39. May	A. A. College	1 (3 counts)	310	69	38/8	10.2	12/3	3/2	0
,, June	,, ,,	1	150	164	5/84	59.3	4/73	1/5	0
,, July	,, ,,	1	140	85	1/25	18.5	0/55	0/3	0
,, Aug.	,, ,,	1 (2 counts)	260	58	1/3	1.5	2/42	0/3	0
TOTAL		1 (7 counts)	860	376	45/120	19.1	18/173	4/13	0

Column 5 shows total aphids of all species including winged and wingless forms.
Columns 6, 8, 9, 10, show the number of winged and wingless forms of the potato feeding species, thus 6/2 Myzus persicae = 6 winged and 2 wingless forms of this species.
Column 7 shows the number of Myzus persicae per 100 leaves expressed in decimal form.

TABLE II.

Station	Years	Relative Humidity (Monthly Average)
Malin Head	1921–35	Not less than 84%
Blacksod Point	1929–35	,, ,, ,, 75%
Valentia	1921–35	,, ,, ,, 72%
Roches Point	1921–35	,, ,, ,, 79%
Birr Castle	1921–35	,, ,, ,, 71%

TABLE III

Month	Blacksod Point		Malin Head		Birr		Valentia		Roches Point	
	1938	1939	1938	1939	1938	1939	1938	1939	1938	1939
April	0	2	0	2	17	9	1	0	1	0
May	1	0	0	1	8	12	0	0	0	0
June	0	3	0	3	8	14	0	1	0	1
July	0	0	0	0	7	4	0	0	0	0
August ..	0	3	0	1	6	13	0	0	1	0
September* ..	0	5	1	0	9	6	0	0	1	0
TOTAL ..	1	13	1	7	55	58	1	1	3	1

*Up to and including September 28th, 1939, only.

Again it is noticeable that except in the midlands (Birr Station) days on which conditions for flight are suitable occur infrequently. The chief controlling factors here are high wind velocities and high relative humidities. Consequently it may be said that conditions in our best seed potato producing areas are not in favour of high populations of *M. persicae* on our potato crops. This is borne out by the results shown in Table I.

Discussion.

From the results of the present survey it is apparent that the number of potato-feeding aphids in certain of the seed-producing areas in Ireland is low and this may be attributed mainly to scarcity of suitable winter food plants. Observations by the present writer at the Albert Agricultural College, Glasnevin, go to show that *M. persicae* overwinters in the viviparous state on winter brassicas. Sexual forms of this species have not been found, and it is unlikely that they occur. That the viviparous forms can withstand very low temperatures is shown by an examination of

GROUP OF TEACHERS AND PUPILS

winter brassicas after the severe frost of January and February, 1940. During this period the average temperature was 13.6°F. for the five days ending January 21, 1940, while the average for the previous six days was °F.

In spite of these conditions an examination of Savoy cabbages on 6th February, 1940, revealed the presence of four viviparous *M. persicae* on 80 leaves. The complete isolation of our seed potato districts from urban areas where winter brassicas are likely to be grown renders them safe from infestation by winged migrants in spring. It would seem also that they are further safeguarded since atmospheric conditions in our coastal seed potato growing areas appear for the most part to be unsuitable for movement of winged aphids. The present writer, however, regards meteorological records of little use when applied to the conditions under which the aphids live. Conditions close to the leaf surface near soil level are not similar to those in the upper air. In the case of wind velocity conditions at the leaf surface are more likely to be favourable for flight than they are at some distance from the tops of the host plants. It has been computed that the wind velocity at 33 ft. (10 metres) is approximately twice that at 1.5 ft. (0.5 metres) above soil level. Consequently it is likely that conditions at the leaf surface may induce aphids to take to the wing and that once in the open the greater wind velocity would cause them to be carried great distances. Relative humidity in the vicinity of a feeding aphid is also likely to be greater than that in the open due to transpiration from the leaf surface. This would tend to retard movement as would also the decrease in light intensity on the undersurface of a leaf.

In the areas in which the survey was made it was found that certain aphis species other than potato-feeding ones occurred in large numbers. Thus, a species identified as *Myzus polygoni* Buckt. occurred on Polygonum persicariae growing amongst potatoes while *Macrosiphum jaceae* Linn. on Centaurea nigra, *Aphis rumicis* Fabr. on Rumex, *Macrosiphum rubiellum* Theo. on Rubus fruticosus, and *Macrosiphum sonchi* Linn. on Sonchus occurred in abundance in the vicinity of potato fields in all areas. Where cabbage could be found growing, examinations generally showed the presence of *Brevicoryne brassicae* Linn. In these circumstances therefore it may be said that conditions for the development of *M. persicae* would have been suitable had this species been present.

The almost complete freedom of some of our seed-producing districts from potato-feeding aphids and the extremely low numbers in others explains why potato stocks can be maintained at a high level of health in these areas. It has in fact been found possible, where leaf roll was introduced in new stocks into these areas, to render these stocks free from the disease by careful inspection and removal of the diseased plants. Such a task would be regarded as impossible in an area in which populations of potato feeding aphids were high.

SUMMARY.

A survey of the aphis population of potato crops in Ireland was carried out during 1938 and 1939.

The areas in which the survey was made and the method adopted are described.

M. persicae occurred in negligible numbers at most centres, the highest being obtained at the Albert Agricultural College, Glasnevin, where the potato plots were close to a market garden.

Conditions affecting the number of *M. persicae* are discussed and it is concluded that conditions in the seed-growing areas in the West of Ireland are not such as to promote big populations of this insect.

It is considered that the present isolation of health stocks of potatoes as practised in Ireland is adequate provided such stocks are planted in areas of low aphis populations.

Acknowledgments.

The author desires to extend thanks to the Officers of the Department of Agriculture for their generous co-operation during the work of making the present survey : to Dr. R. McKay and Dr. P. Clinch of the Department of Plant Pathology, Albert Agricultural College, Glasnevin, for advice and suggestions during the preparation of the manuscript ; and to the Director, Meteorological Office, Dublin, who so kindly supplied a number of meteorological records.

References.

1. Bryan, H. (1932) Journ. Agr. Sci. 22, 2, 358-365.
2. Coad, B. R. (1931) Yearbook U.S. Dept. Agr. 320-323.
3. Davies, W. M. (1934) Ann. App. Biol. 21, 2, 283-299.
4. ,, (1935) ,, ,, ,, 22, 1, 106-115.
5. ,, (1936) ,, ,, ,, 23, 2, 401-408.
6. ,, (1938) ,, ,, ,, 25, 1, 122-142.
7. ,, (1939) ,, ,, ,, 26, 1, 116-134.
8. Jones, L. K. (1934) Phytopath. 24, 10, 1144.
9. Patch, E. M. (1921) Maine Agr. Exp. Sta. Bull. No. 303.
10. ,, (1928) ,, ,, ,, No. 346.
11. Profft, J. (1939) Arb. physiol. angew. ent. Berlin, 6, 2, 119-145.
12. Roney, J. N. (1932) Journ. Econ. Ent. 25, 4, 776-780.
13. Salaman, R. N. and Wortle, W. R. S. (1939) Nature 144, 1049.
14. Averages of Humidity for Brit. Isles. M. O. 421 H. M. Sta. Office.

(Received for publication on the 2nd July, 1940.)

HEAT CANKER OF FLAX.

By

ROBERT MCKAY, D.Sc., Department of Plant Pathology,
Albert Agricultural College, Glasnevin, Dublin.

In the Reports on Investigations on Flax Diseases by Pethybridge, Lafferty, and Rhynehart, which appeared in earlier volumes of this Journal* no mention is made of any disease which could possibly be identified with that described in America as heat canker,† and the conclusion is that these workers did not meet with this trouble during the course of their investigations. Furthermore, numerous specimens of diseased flax are received each year by the Department of Plant Pathology from the Flax Inspectors in the various counties, but prior to 1939 there has been no record on the files in this Department of the occurrence of any injury on flax resembling that about to be described. Heat canker of flax is a disease, therefore, which is either rare in this country, or which when it occurs is not recognized. Indeed, the only previous note on the occurrence of this disease in Europe appears to be that by Van Poeteren in Holland.‡

Occurrence and Description of the Disease.

During the third week of June, 1939, samples of flax from three separate farms in Co. Donegal were received from Mr. J. MacArdle, Flax Inspector, Department of Agriculture. These plants were from three to five inches high and presented the appearance illustrated in Figs. 1 and 2. The aerial portions were turgid and appeared healthy though it was evident that some of the plants had been prostrate on the ground, as was indicated by the curvature of their tops. The most characteristic feature, however, was the constriction of the stems at the soil level. In some cases the stem tapered fairly regularly in the affected region but in others the line of demarcation between the normal and constricted portions was quite abrupt (Fig. 2). There was also a slight tendency to swelling of the stem just above soil level and adventitious roots tended to develop from the swollen areas wherever these had been in contact with the soil surface. The general root systems of such plants were thin and thread-like (Fig. 2), their non-development being due to starvation. Microscopic examination showed that the cells of the cortex at the point

* Journal Department of Agriculture and Technical Instruction for Ireland, Vol. XX, pp. 325-342, 1919-1920; Vol. XXI, pp. 167-187, 1921; Vol. XXII, pp. 103-120, 1922-1923.

† Reddy, C. S., and W. E. Brentzel. Investigations of Heat Canker of Flax. United States Department of Agriculture. Bulletin 1120, Oct. 26, 1922.

‡ Review of Applied Mycology. Vol. III, p, 317, 1924.

of constriction were dead and shrunken, so that the downward flow of manufactured food materials from the top of the plant was inhibited, whilst the latter was kept supplied with water and minerals through the uninjured vascular tissue. Some of the plants were almost completely severed at the point of constriction and in a small number the constricted areas were darkened by an attack of the fungus *Corticium Solani* (*Rhizoctonia Solani*) thus appearing as though infected by ordinary "damping-off." However, more than 90 per cent. of the affected plants were entirely free from any parasitic organism and it was clear that even where the fungus *Corticium* occurred it was very superficial and merely a secondary invader of already damaged tissue.

Further investigation of the subject showed that the maximum height of the constricted plants and the type of injury present agreed exactly with the description of heat canker of flax as given by Reddy and Brentzel (*loc. cit.*). This diagnosis was supported by the observations made by Mr. MacArdle at the time the disease was found. The plants were collected on 16th June, 1939, and the observations supplied were the following:—"On all three farms the soil was of a peaty nature. On two of them the affected plants occurred chiefly in the furrows, whilst on the third farm the disease occurred in patches throughout the field. The weather prevailing at the time was very warm but heavy rain had fallen a few days previous to the day on which the affected plants were seen."

American Investigations of Heat Canker of Flax.

This disease is reported to be common in the United States of America, occurring somewhat uniformly each year in the flax producing section of the Northern Great Plains area. The losses caused from it vary from slight to severe. Reddy and Brentzel (*loc. cit.*) had the disease under observation in 1916 and published a full account of their investigations in 1922. As this Bulletin is naturally not very well known in this country the following extracts from it are here quoted :—

> "The soil crust caused by rains brings the surface soil in immediate contact with the tender surfaces of the succulent young flax stems. Injury results when such surface layers in immediate contact with the tender living tissues reach the high temperatures. The surface crust may act as a conductor of heat to the plant. In contrast with this condition, when the top layer of the soil is mellow, which was the condition in late June, as previously pointed out, the little air pockets about the young plant stems tend to act as insulators and protect the stems from the high temperatures.
>
> The evidence, therefore, indicates that heat canker of flax results from a combination of succulence in the young plants and high temperatures of the surface soil in immediate contact with such succulent tissues . . . .

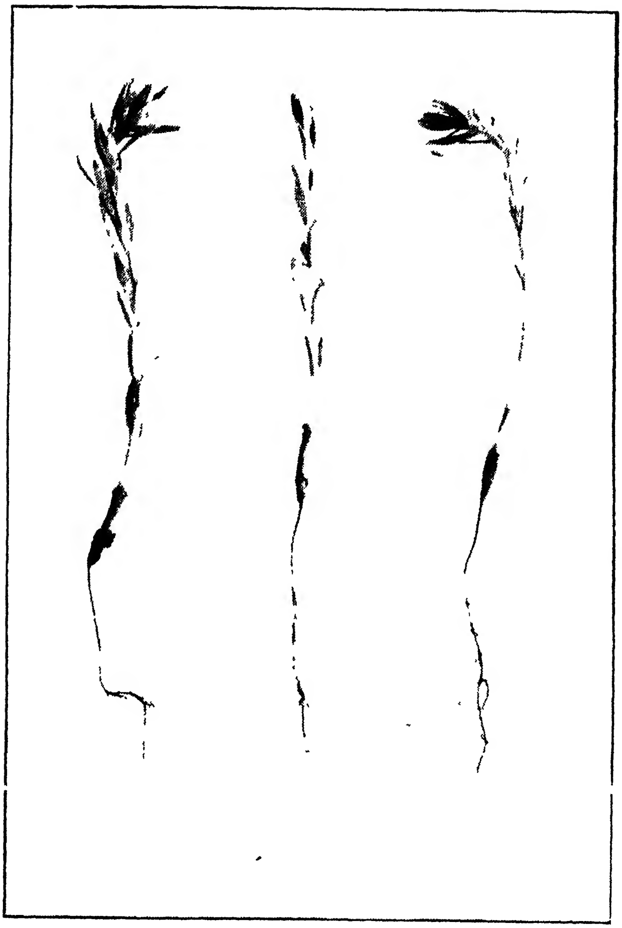


Fig. 1.
Flax seedlings showing injury due to heat canker at soil level
(Natural size, June, 1939.)

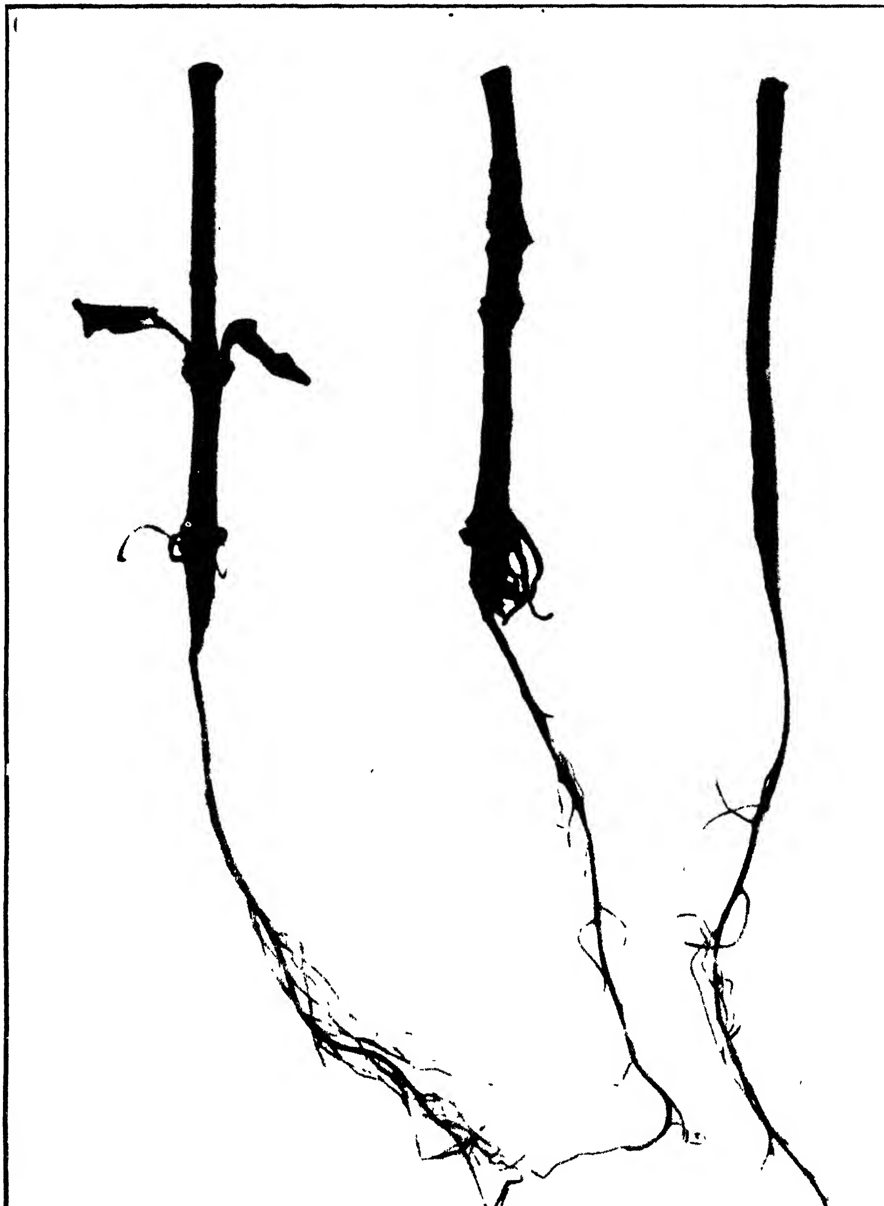


Fig. 2.

Enlargement of basal portion of flax seedlings injured by heat canker, showing constricted areas, roots thin and starved, and attempt at development of adventitious roots immediately above the injury.

The cortex of the stem is killed at the surface of the ground. Sooner or later the cankered plants topple over. Young cankered plants die at once, while those that are a little older may remain alive for days or weeks, as long as the vascular systems function. Stems of the older cankered plants usually enlarge just above the injury, and sometimes just below it. The result is a girdling of the plants at the soil line.

In these experiments and observations flax was cankered only during and immediately following very hot days. Flax plants when more than 4 inches high are only slightly susceptible. Flax plants which have developed under hot, dry conditions are less susceptible to injury from high soil-surface temperatures than more succulent plants.

Flax plants which are grown in a soil having a shallow surface mulch over a firm seed bed are less readily injured than those grown in soil in which the surface layer has been compacted into a crust by rains. Plants shaded by a vertical strip of canvas 10 inches high were not cankered, while many unshaded plants in the same row were cankered. Thinly-sown flax was cankered more than thickly-sown flax . . . .

Killing the cortex of young flax plants by artificial heat produced heat canker."

Discussion.

A pinched or constricted appearance of flax stems particularly in the neighbourhood of the soil was described by Pethybridge and Lafferty in this Journal, Vol. XX, page 327, as one phase of "seedling blight" (*Colletotrichum Lini*). This symptom occurs frequently on flax brairds when heavily infected with *C. Lini* especially in wet years which favour the growth of the fungus. Constriction of stems due to *C. Lini* can be readily diagnosed by the following features :—

(*a*) The stem lesions are usually accompanied by discoloured areas on the foliage, (*b*) the lesions are dark and have a slightly water-soaked appearance at their margins, (*c*) the stem is approximately of the same diameter above and below the constriction, (*d*) examination of the lesion with a good lens or with a microscope reveals the presence of minute black hairs, the *setae*, which are characteristic of the fungus. Moreover, incubation of diseased stems for a few hours in a moist chamber results in a prolific development of the spores of *C. Lini*. From what has been said of heat canker it is clear that the latter is a condition unassociated with "seedling blight."

For the production of heat canker a high soil temperature is necessary and this must occur when the plants are less than five inches high. The American investigations showed that the critical temperature for the production of this disease is about 54°C. The coincidence of such a relatively high soil surface temperature with the early stages of flax growth is rare in this country, and this no doubt explains why the disease has not occurred, or has been overlooked, up to the present time. In 1939, however, the weather was exceptionally hot towards the latter end of May and early in June and the development of heat canker in that year is therefore not surprising, especially in crops grown on black, peaty soils. It is well known that dark soils, rich in humus, can attain high temperatures, although no actual figures are available for the farms where the disease occurred. Owing to the exceptional conditions under which heat canker develops the disease is not likely to be of much economic importance here but at the same time it appears desirable to record its occurrence and symptoms so that it may be distinguished from other flax diseases.

(Received for publication on 12th June, 1940).

NOTES AND MEMORANDA.

THE BREEDING OF HERBAGE PLANTS IN SCANDINAVIA AND FINLAND.

Herbage plants occupy a place of considerable importance in the agriculture of the Northern Countries. In Sweden and Denmark breeding work with herbage plants has been in progress since the early years of the present century. In Norway and Finland the work began very much later.

Developments in this connection in the countries mentioned are described in a series of articles collected and published in " Joint Publication (No. 3) " of the Imperial Agricultural Bureaux. The publication has been produced by the Imperial Bureau of Plant Breeding and Genetics, Cambridge, and the Imperial Bureau of Pastures and Forage Crops, Aberystwyth. The articles, which have been written by acknowledged specialists in their respective countries, include details of the most recent improved strains of grasses, clovers and lucerne and the methods used in producing them and are as well a valuable summary of the results of the application of cytology to herbage plant breeding.

In general, plant breeding work in the four countries has been carried on with the collaboration of the seed trade and the placing of improved varieties on the market has been thereby facilitated. The benefit to the seed trade of successful breeding work with a given crop is evidenced by the fact that in a number of cases the country concerned has been enabled to become independent of supplies of foreign seed of that particular crop.

Copies of the Publication (price 4s.) may be obtained from the Agricultural Bureau at Cambridge or the Agricultural Bureau at Aberystwyth.

THE SILAGE QUESTION IN DENMARK.

In an article published last February Mr. K. M. Nielsen, an officer of the Danish Ministry of Agriculture, has dealt very fully with the ensilage question in relation to his country's needs. He points out that this question is not a new one and it has always come to the fore in times of emergency, and is just now being closely studied in most European countries. The all-important problem of how to supply the raw material necessary if production is to be maintained has to be faced in agriculture no less than in industry. Sufficient protein

for the feeding of live stock must be available and every possible source of that supply, including silage, must be carefully considered.

After describing the different methods of ensiling green crops, and comparing the results obtained, the writer sums up as follows :—

Speaking generally, the results of experimental and practical experience point to the fact that it is possible to ensile, without much difficulty, most green crops. The ensiling process, moreover, is particularly well adapted to the conservation of green crops containing much protein, and also of root tops.

In the actual hay-making season, it will be well to make hay as heretofore, but at other times in both summer and autumn, silage should definitely be prepared. The two products supplement each other admirably and both should have their place on most farms. Although perhaps more suited to conditions on holdings of the larger type, the preparation of silage should not be neglected on small farms where it affords a useful means of utilizing root tops.

It is perhaps doubtful whether silage making will ever become as general in Denmark as it has in certain other countries where conditions are less favourable to the making of hay. In times of stress it should certainly not be neglected.

Farmers should not expect too much from the method but should adopt it only when there is a prospect of success under normal conditions. The greatest care and accuracy should be observed in preparing the silage; otherwise, there will be more disappointments than ever. On the other hand, it would be wrong to turn the whole thing down, because the method has advantages which it would be wrong not to utilize in times of emergency like the present.

SEED POTATO CUTTING IN GERMANY.

In view of the heavy demand for seed potatoes in Germany during the spring of 1940, the question was again discussed as to whether seed tubers should invariably be planted whole or may, if necessary, be cut into two or more pieces without impairing the yield.

In so far as exact experiments are available, results have not been favourable to the latter practice. When a seed tuber is cut, it is obvious that the food supply of the young plant is thereby reduced, and the crop raised from cut seed may amount to only 60 per cent. of the normal yield.

According to a German writer, cutting is only permissible if the supply of seed potatoes has entirely failed or if there is a shortage of table potatoes. In such circumstances, large table potatoes should be chosen, and the upper end, with the eyes, cut off for seed. These sets should at once be plunged in ashes to prevent loss of juice.

To cut small-sized seed in half lengthwise is entirely wrong. Moreover, on large farms the practice would be costly, especially in these days when workers are scarce.

A better plan than cutting is to use a smaller size of potato for seed purposes, provided of course, that these small sets show no symptoms of virus disease.

On the whole, therefore, the cutting of seed potatoes is not recommended by German authorities except in times of great emergency.

PRUNING METHODS MAY AFFECT KEEPING QUALITY OF FRUIT.

The Swiss Horticultural Experiment Station at Wadenswil has been studying the problem of the effect of different systems of pruning on the keeping quality of fruit. Pruning is naturally of prime importance where the production of first-class fruit is concerned, and the art has been brought to great perfection in Switzerland where standardized methods are being gradually adopted all over the country.

It is a well-known fact that trees subjected to drastic pruning react by throwing out a large number of leafy shoots and by producing fruit of more than the average size and showing a certain coarseness of quality. Such fruit does not keep satisfactorily. The experiments were undertaken in order to discover why individual trees and certain varieties react in this way and under what conditions fruit retains or recovers its natural keeping quality.

One set of experiments was conducted with pairs of similar trees which were differently treated and pruned. The fruit of these trees was graded and cold stored immediately after having been gathered. It was checked over every month and decayed or diseased fruits were removed. Another set of tests related to the crop gathered from individual trees, the fruit from each branch being gathered separately. Branches were treated in different ways, *e.g.* by ringing, thinning, removal of leaves or portion of the crop of fruit, and were judged either separately or in comparison with other branches.

The results obtained were as follows :—

(1) The fruit of trees which had been severely cut back and thinned out

was less resistant to storage diseases. This was particularly true of trees which had borne only a light crop. Very unfavourable results were obtained from fruit gathered from branches which had been ringed and the fruit of which had been reduced by one-third by thinning. Ringing or thinning alone did not in all cases reduce the keeping quality. Fruit from ringed branches, portion of the leaves of which had been removed, kept at least as well as the untreated control.

(2) Speaking generally, the keeping quality of fruit suffers in proportion as the food balance between the total leaf area and the number of fruits turns in favour of the former. Where there is a big reserve of carbo-hydrates with a relatively small crop of fruit, the latter ripens too soon and keeps badly.

(3) Observations on apples gathered at different stages of their development showed that varieties subject to brown spot should not be gathered too late.

(4) In order to preserve the resistance proper to each variety, care must be taken to avoid reducing the tree's yield for any length of time. Trees which have been pruned properly from the start, sprayed and manured (not merely with liquid manure) and have therefore borne average or heavy crops regularly each year yield the best fruit for keeping purposes.

COLORADO BEETLE MENACE: BELGIAN ORDER.

The Ministry of Agriculture in Brussels made an Order dated 13th August, 1939, relating to special measures to be taken in districts where horticultural produce is grown for exportation. Under this Order, potato crops situated within 6 miles of gardens where produce is grown for exportation must be treated in a satisfactory manner with arsenate of lead or arsenate of lime at least twice a year, or with mixtures such as "Rotenone," which act by contact, at least three times a year. One kilo (2.2 lb.) of arsenate of lead is sufficient to prepare 44 gallons of mixture for the treatment of about half-an-acre of potatoes.

COMPOST MADE OF PEAT AND LIQUID MANURE.

Some experiments have been made in Germany in the preparation of compost from peat and liquid manure. Two composts (A and B) were prepared. Compost A consisted of peat, liquid manure and 18 per cent. superphosphate (100 parts of peat and 21 of superphosphate) and Compost B consisted of peat and liquid manure to which basic slag was afterwards added. Both peat and peat plus superphosphate were spread twice daily in the drainage gutter of the manure heap. After they had absorbed the liquid manure, the content of nitrogen was determined and the mixtures

were conveyed to cement containers the bottoms of which were covered with a layer of earth. The mixtures were prepared during the period from 12th December to 8th January and were covered in with the same kind of earth as was used to cover the floors of the containers. The content of dry matter, total nitrogen, potash, and phosphoric acid was ascertained and also the content of dry matter and nitrogen in the peat. The mixtures were stirred with the shovel on 15th March and 12th April. On the latter date, as much phosphoric acid in the form of basic slag was added to Compost B as was added to Compost A in the form of water-soluble phosphoric acid. On 14th May, samples were taken for analysis, and the composts were again piled up and kept until October.

The storage experiments showed that marked nitrification took place in both composts. Reaction had advanced on the acid side, mostly in the superphosphate compost, where nitrification stopped at the reaction index 4.4. In the assimilation processes, which proceeded during the same period 19 per cent. of inorganic nitrogen in Compost A and 33 per cent. in Compost B were transformed into organic nitrogenous compounds.

The nitrogen contained in the liquid manure just after its absorption into the peat mass suffered some loss during storage, *i.e.* up to 14th May. This loss amounted to 7.5 per cent. in the case of the superphosphate compost, and to 33 per cent. in that of the basic slag compost.

In field trials, a crop of maize received a dressing of compost equivalent to 35 lb. of liquid manure nitrogen per acre. A mineral manure was also used at the rate of 35 lb. N. per acre plus potash and phosphoric acid equivalent to the content in the superphosphate compost. The biggest yield was obtained after the dressing with superphosphate compost. Utilization of nitrogen, *i.e.* N. recovered expressed as a percentage of the N. added, was best in compost manures.

PROPER PLACE OF SILAGE IN THE RATION.

German farmers, it seems, are often disappointed at the results achieved from the introduction of silage making on their farms. Milk yields and fat percentages do not show an increase and may, indeed, show some decline. And yet the ensiling process has, in most cases, been correctly carried out. The material used has been young, fresh and juicy, the acid employed has been precisely measured, the air—that " greatest enemy of conservation " —rigorously excluded, excessive juice drawn off, and the full silo carefully covered in. The finished product may find ready acceptance with the cows, and may exhibit all the qualities of good silage :—high protein content, normal percentage of lactic acid and acetic acid and, as a rule, absence of

butyric acid. And yet, when fed in conjunction with hay and perhaps some concentrates, the silage diet has not produced any increase in the milk yield of the cows. Strangely enough, results may even turn out better where the silage used has been of relatively inferior quality, *e.g.* beet foliage silage from earth clamps.

Nevertheless, says a German writer, it would be fundamentally wrong to condemn on this evidence the practice of ensiling generally, or to lay the blame for failure on the silage itself. Clarity on this question can, he says, only be attained in one way, namely *by ascertaining precisely the nutritive content of the total food ration.* In almost every instance where success was not obtained in feeding silage to dairy cows, closer investigation has shown that the protein-starch ratio in the dietary was unfavourable, and in most cases there had been a waste of protein. Since, by the law of minimum, the milk yield of cows depends upon the nutrient of which they receive the smallest quantity, a cow receiving a ration containing enough protein for about 20 litres of milk (in addition to a maintenance ration) but only starch values enough for 12 litres, can seldom produce more than 12 litres of milk. The surplus protein cannot be properly utilized by the animal, and thus a waste of protein occurs.

The writer analyses several dairy cow rations as used on two different farms—one with heavy soil and growing sugar beet, the other with light soil and catch crops—and shows where the balance between protein and starch values has not been properly kept, with the result that milk yields have been unsatisfactory.

He concludes that the important thing is not merely to feed silage, but *to give silage its proper place in the food ration.* It should never be forgotten that animals can only absorb a certain quantity of ballast. The silage itself should also be tested from time to time for its content of crude protein and dry matter and also for its content of acids. The results of these investigations will provide answers to several important questions, *e.g.* : Has the fodder been cut at the right time, and what is its nutrient content ? Has it been ensiled properly, and what is its acid content (pH index), especially of lactic acid ?

BOLTING OF ROOT CROPS : SWEDISH EXPERIMENTS.

During the late summer of 1938, root crops in Southern Sweden began to be marked by an unusually high percentage of bolting plants. Sugar beets had in many cases 10 per cent. and upwards of bolters, while in some instances percentages of 25 to 35 gave the fields the appearance of a seed crop rather than a root crop.

Spring started unusually early in Southern Sweden in 1938, with the result that root crops (including sugar beet) were sown at widely different dates. The temperature during spring and early summer was rather low and the sky mostly clear, so that conditions were particularly favourable to bolting.

Early-sown swedes showed a marked tendency to bolt. In one field 80 per cent. of bolters were noted. In another field, one-half of the ground had been sown with Bangholm swedes, and the other half two weeks later with the same seed. An inspection at the end of September showed that the later-sown seed produced hardly any bolters, while the early-sown portion had about 30 per cent.

In order to test the bolting proclivities of various root crops, the Swedish Seed Association began an experiment at Svalöf on 31st March, 1938. Sixteen strains of sugar beet, 6 of half-sugar beet, 6 of mangolds, and one each of swedes and turnips were tested in three series of replica sowings. Of the sugar beet strains, Klein Wanzleben E (a German strain) and a Svalöf strain (015) showed the least tendency to bolt, their averages for the series being 26.1 and 27.1 per cent., respectively. Of the mangolds, Nos. 29 and 30, derived from Svalöf strain No. 01 showed marked resistance to bolting, with averages of 8 and 9.7 per cent. respectively. The swede variety tested (Yellow Swedish) had an average of 91.3 per cent. of bolters, and the turnip variety (Bortfelder) had nearly as many, namely 86.5 per cent.

which he worked varied from less than 10 per cent. to more than 90 per cent. and he divided the varieties into three groups according to the degree of susceptibility to leaf roll exhibited by them under the conditions of the experiment. Murphy and McKay (4) in an experiment with eight potato varieties state that the results failed to demonstrate that any variety possesses a well-marked power of resisting infection with leaf roll. They point out, however, that the disease once contracted is more serious on some varieties than on others. In the same paper these authors show the comparative weights of leaf roll and healthy plants of a number of different varieties taken over a period of three years.

Murphy (5) in a paper in which is summarised the information available on the leaf roll disease has divided potato varieties into two groups as follows :—

Infection most prevalent. President, Arran Consul, Dunbar Yeoman, Dunbar Cavalier, Arran Cairn, British Queen, Up-to-Date, Kerr's Pink, Majestic, King George V, Katie Glover, King Edward VII, Arran Pilot, Duke of York, May Queen, Sharpe's Express.

Infection least prevalent. Flourball, Shamrock, Resistant Snowdrop, Skerry Champion, Champion, Great Scot, Arran Chief, Ally, Templar, Epicure, Eclipse, Ninetyfold.

These are two very broad groups and are compiled from observations in the field on the occurrence of leaf roll in the different varieties.

In the same paper potato varieties are divided into three groups according to the effects of leaf roll on their vigour and yield and it is stated that the yield of affected plants is reduced more or less in proportion to the reduction in vigour. Whitehead (7) on the other hand is of opinion that the degree of rolling of the foliage shown by an infected plant is not a reliable guide to the probable loss in yield. This author suggests that the degree of aphis infestation determines whether differences in susceptibility between varieties will be apparent, light infestations giving some indication of differences but that under conditions of heavy infestation no differences in susceptibility may be apparent. He states, however, that the effect of leaf roll on the yield is the best criterion of susceptibility and on this basis has constructed a table of susceptibility of fifteen varieties.

As a result of experiments in Denmark, Nielsen (6) divides the potato varieties with which he worked into three groups according to their susceptibility to leaf roll. Experiments in America (1) indicate that differences in the amount of infection with leaf roll contracted in the different varieties have been observed and the conclusion has been drawn that the varieties in cultivation there vary in their susceptibility to the disease.

The effects of leaf roll on the older varieties are well known and need not be described here but before dealing with the present experiments it may be well to describe the effects of the disease on some of the newer varieties.

Arran Peak.—Some rolling of lower leaves, but this is not a pronounced symptom. Affected plants pale and somewhat stunted. Vigour reduced somewhat more than British Queen (Fig. 1).

Arran Signet.—General pallor especially in tops. marked rolling of lowest leaves. Considerable reduction in vigour, being intermediate between President and British Queen types (Figs. 2 and 1).

Dunbar Standard.—Plants very erect, pronounced pallor. Rolling of lower and middle leaves. Height reduced by about two thirds. Very great reduction in vigour. Approaching President type, but not as severely stunted. (Fig. 2).

Dunbar Yeoman.—Rolling of lower and middle leaves severe. Top leaves erect and slightly rolled. Very much reduced in vigour. Like Arran Signet. Between President and British Queen types (Figs. 2 and 1).

Gladstone.—Plants have a "straggling" appearance. Definite rolling of lower leaves. Not much loss of colour. About British Queen type (Fig. 1).

Redskin.—Rolling of lower and middle leaves. Slight pallor in tops. Very much reduced in vigour. Between British Queen and President types (Figs. 1 and 2).

Ulster Monarch.—Rolling of lower leaves which may extend slightly to middle leaves. No reduction in green colour. Plants more compact than normal. Reduction in vigour not pronounced. Between British Queen and Up-to-Date types (Figs. 1 and 3).

As regards the effects of leaf roll on vigour therefore, the varieties dealt with here may be divided into three groups as follows :—

Group I. Effects most severe.—President, Arran Crest, King Edward, May Queen, Dunbar Standard.

Group II. Intermediate class.—Dunbar Yeoman, Arran Signet, Redskin, Arran Pilot, Epicure, Arran Banner, Gladstone, Majestic, Arran Cairn, Kerr's Pink, Arran Peak, British Queen, Eclipse, Arran Victory, Ulster Monarch.

Group III. Effects least severe.—Up-to-Date, Great Scot, Flourball.

Fig. 1—Potato plant. British Queen type, showing leaf roll. Rolling of the leaves is general over the plant, but there is no marked stunting of growth.

Fig. 2 --Potato plant, variety President, showing leaf roll. There is great reduction of vigour and loss of green colour in this variety.

The experiments described here were designed by the late Professor Paul A. Murphy in collaboration with the present author. Shortly after the commencement of the experiments Professor Murphy became ill and subsequently died. The present author is, therefore, alone responsible for the compilation of the results and the conclusions drawn from them.

Objects and Layout of Experiments.—The object of the present experiments was to ascertain the susceptibility to leaf roll of a number of potato varieties, particularly those of recent introduction. The first trial was carried out in 1937 using the varieties recorded in Table I. The healthy tubers used in the experiments were obtained through the courtesy of the Department of Agriculture from Mr. P. Keenan, Inspector in charge of Health Stocks, to whom the author desires to extend thanks. These tubers were of a very high standard, there being complete absence of leaf roll in the resulting plants prior to infection from the sources to which they were exposed in the experiments.

Fig. 1 shows the layout of the experimental plots. A drill of twelve leaf roll British Queen tubers was planted between each five drills of the varieties under test. The varieties were numbered one to twelve in the order in which they appear in Table I and were randomised in each drill at planting time, the arrangement being attained by taking at random out of a box slips of paper bearing the variety numbers. Each plot was surrounded by healthy British Queen plants to act as a barrier in preventing the spread of leaf roll from adjoining plots.

Notes were made during the growing season of 1937 on the occurrence of primary leaf roll in the test plants and at the end of the season the progeny of each plant was lifted and stored separately.

Aphis counts on Experimental Plots 1937.—Counts were made of the aphis population in the experimental plots during the growing seasons of 1937 and 1938 and these are of interest in view of the subsequent spread of leaf roll. Since *Myzus persicae* was the only aphis species recorded which can act as an efficient vector of leaf roll, figures for this species alone are given. In both years the experimental plots were situated in the same field adjoining a market garden in which winter cabbages were grown. It is known that *Myzus persicae* can overwinter in the viviparous state on winter brassicas, hence the importance of this host. During the spring of 1937 and previous winter, cabbages in this garden were examined and apterous *M. persicae* were found on them. An examination in early May, 1937, however, showed that although the infestation was slight a large proportion of the aphids present were developing wings. On May 13th two alate *M. persicae* per 100 leaves were counted on the potatoes and migration of aphids appears to have continued to them, causing a rapid increase in numbers, until about the middle of June. After that time the infestation by alatae

decreased rapidly and since this was so with apterous forms also it may be said that the middle of June was the time at which maximum infestation occurred in 1937, the maximum number of live aphids counted being 162 per 100 leaves.

Susceptibility of varieties 1937 *experiment. Development of primary leaf roll:*– During the growing season of 1937 the development of primary leaf roll in the experimental plots was observed. The numbers of plants in each variety which developed primary leaf roll are shown in Table I. In 1937 it was possible owing to the number of observations made on development of primary leaf roll in the plots to ascertain the number of plants which became diseased during different portions of the growing season. It will be seen from Table I that during the month of June practically no primary leaf roll had developed in any of the varieties.

TABLE I.

Development of Primary Leaf Roll, 1937

Variety Number	Variety	Number of plants showing primary leaf roll on				
		30th June	16th July	31st July	19th August	31st August
1	Arran Cairn	1	12	24	28	30
2	,, Peak	0	7	16	17	20
3	,, Pilot	0	2	8	8	9
4	,, Signet	0	3	9	13	15
5	Dunbar Standard	0	5	10	15	18
6	,, Yeoman	0	2	6	6	6
7	Gladstone	0	0	9	16	21
8	Redskin	0	4	10	14	15
9	Ulster Monarch	0	0	4	5	12
10	British Queen	0	1	3	5	8
11	Flourball	0	3	7	10	11
12	President	0	10	19	21	22
	TOTAL ..	1	49	125	158	187

By the middle of July, however, a total of forty-nine plants in all varieties was showing symptoms, while the greatest number developed the disease in the latter half of July. The number which developed primary leaf roll during August is half of that showing the disease during July. According to Murphy (5) when the aphis *M. persicae* infects a potato plant with leaf roll through the sprouts, the incubation period, that is, the period between infection and the development of symptoms, is variable but may be only a matter of some days. When young plants are infected the incubation period is 30-40 days, with older plants it may be 40-60 days and with full-

Fig. 3—Potato plant, variety Up-to-Date, showing leaf roll. The lowest leaves only show marked rolling, while the reduction in the vigour of this variety is generally very moderate.

grown plants no symptoms may be produced during the year of infection, the incubation period extending overwinter in the tubers.

It has been shown that the time of maximum infestation by *M. persicae* in 1937 occurred about the middle of June. Aphids were present on the plants from the middle of May but not in appreciable numbers until the beginning of June. As the plants are young at this stage and allowing 30-40 days as the incubation period, symptoms of primary leaf roll would begin to show about early July, while the period of maximum aphis infestation agrees closely with the period of maximum development of primary leaf roll symptoms, that is during the latter half of July.

Development of secondary leaf roll in 1938.—Five tubers from each of the plants exposed to infection in 1937 were planted in 1938 and observations were made on the development of secondary leaf roll. If leaf roll developed in a single plant of the five, the unit was regarded as having contracted infection in 1937. The examination was made during the first week of July since it was considered that at this period no secondary leaf roll would have developed from current year infection, also affected plants display symptoms best at about this period.

TABLE II.

Results of 1937 Experiment.

Variety No.	Variety	(1937) Number of plants which displayed primary leaf roll in drill					Total P.L.R.	(1938) Total number of plants which contracted leaf roll infection in drill					Total S.L.R.	Per. cent. S.L.R.
		1W	1E	2W	2E	3	*	1W	1E	2W	2E	3	*	
1	Arran Cairn	10	8	1	7	4	30	13	12	7	15	7	54	54
2	" Peak	3	4	5	4	4	20	10	8	4	8	6	36	36
3	" Pilot	2	5	1	1	0	9	8	13	9	2	6	38	38
4	" Signet	4	5	1	3	2	15	10	15	7	4	7	43	44
5	Dunbar Standard	5	5	3	1	4	18	7	6	5	2	6	26	26
6	" Yeoman	1	1	2	1	1	6	9	9	8	6	2	34	34
7	Gladstone	6	6	2	3	4	21	11	10	6	5	3	35	35
8	Redskin	4	4	2	2	3	15	6	8	6	2	4	26	26
9	Ulster Monarch	4	3	3	2	0	12	9	13	4	5	2	33	33
10	British Queen	2	3	2	0	1	8	14	11	6	5	1	37	37
11	Flourball	4	4	1	1	1	11	6	9	3	3	1	22	22
12	President	4	9	2	6	1	22	4	10	5	8	1	28	29
	TOTAL	49	57	25	31	25	187	107	124	70	65	46	412	414

*P.L.R.=Primary leaf roll.
S.L.R.=Secondary leaf roll.

FIGURE 4.

TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS
	1	10	7	12	5		9	10	1	2	9		6	8	10	2	8		8	6	8	10	1		7	6	7	6	11	
	11	4	10	3	8		6	11	9	1	7		11	6	3	5	7		4	5	4	8	5		9	12	11	2	8	
	7	8	12	4	12		8	4	4	6	12		4	10	11	9	3		1	7	1	4	4		1	2	6	10	2	
	6	2	4	10	1		3	5	8	4	6		3	1	6	12	10		10	11	3	3	9		11	1	10	7	1	
	2	1	8	5	2		1	2	5	7	11		2	11	7	8	12		12	2	5	2	11		5	8	2	11	5	
	4	9	11	1	9		10	12	2	9	3		12	9	12	6	9		9	1	11	6	2		10	9	9	3	12	
	10	5	9	7	10		11	3	6	11	1		10	3	4	3	11		6	10	7	1	10		8	11	5	5	7	
	3	3	6	6	6		7	7	11	3	4		8	5	9	10	6		2	3	12	9	7		3	5	12	8	9	
	12	11	2	11	7		5	1	7	12	8		5	2	2	11	1		3	4	6	11	12		6	10	3	12	10	
	9	7	1	8	4		4	6	3	5	5		1	7	5	1	4		5	9	10	5	8		2	3	1	1	3	
	8	12	3	2	11		12	9	12	10	2		7	4	8	7	2		11	12	2	12	6		12	4	8	9	4	
	5	6	5	9	3		2	8	10	8	10		9	12	1	4	5		7	8	9	7	3		4	7	4	4	6	

PATH

TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS
	7	8	12	9	11		2	9	6	1	9		3	9	3	5	7		8	2	12	10	5		5	3	9	3	6	
	10	10	6	1	3		3	11	7	7	7		2	8	9	3	3		12	7	7	3	7		8	10	11	1	1	
	6	5	10	2	9		5	5	12	9	8		7	12	1	12	4		5	11	5	6	2		3	9	6	7	9	
	8	3	4	11	10		10	1	2	10	10		1	7	7	10	12		1	12	1	1	9		12	11	12	10	7	
	2	11	1	6	8		6	2	5	4	3		8	11	10	2	8		3	1	2	12	6		4	7	2	9	2	
	9	12	8	3	6		4	6	8	2	12		5	4	11	7	11		7	8	4	7	12		1	5	4	5	8	
	5	1	5	5	2		9	7	4	3	4		10	6	12	1	5		10	5	9	11	11		7	12	10	12	10	
	3	7	2	10	5		7	3	3	8	11		9	3	6	4	10		9	10	8	5	3		11	6	1	11	12	
	11	4	9	7	11		11	12	9	11	6		12	10	8	8	1		4	4	11	2	8		2	1	3	8	11	
	4	2	7	4	1		8	4	10	6	5		4	2	5	6	9		2	6	10	4	10		9	8	5	6	4	
	1	6	11	8	12		1	10	1	12	1		11	5	2	11	6		6	3	6	8	4		10	2	7	2	3	
	12	9	3	12	4		12	8	11	5	2		6	1	4	9	2		11	9	3	9	1		6	4	8	4	5	

PATH

TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS
	9	8	1	12	1		6	9	12	11	4		5	5	2	12	2		12	11	9	6	4		9	8	2	2	5	
	11	3	10	5	7		8	6	10	5	12		8	8	9	1	1		3	10	2	7	6		3	10	8	4	10	
	8	12	7	7	9		7	3	11	2	2		2	7	10	9	6		9	9	4	3	8		11	12	6	5	4	
	4	6	5	2	6		10	4	4	1	9		9	3	8	5	12		5	6	8	9	7		10	11	5	12	3	
	2	2	3	3	12		11	11	7	9	5		11	12	4	10	10		6	2	11	10	10		8	5	9	9	11	
	7	9	2	8	11		12	8	1	8	11		12	6	5	4	5		7	7	6	11	5		6	9	3	1	7	
	12	1	4	6	3		2	1	9	6	1		7	9	1	8	11		8	5	3	1	3		2	4	11	8	12	
	1	7	12	4	10		4	12	2	4	3		10	1	7	2	3		4	8	7	12	11		1	8	1	11	9	
	10	11	9	11	5		3	2	8	3	6		4	4	11	6	8		1	1	5	8	2		7	7	12	3	8	
	6	10	8	9	4		5	7	5	12	7		3	2	12	7	4		11	3	10	4	9		12	6	10	10	1	
	5	5	6	10	8		9	10	3	10	8		1	10	6	11	7		2	4	1	5	1		4	1	4	7	6	
	3	4	11	1	2		1	5	6	7	10		6	11	3	3	9		10	12	12	2	12		5	2	7	6	2	

PATH

TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS	1E	2E	3	2W	1W	TWELVE LEAF ROLL PLANTS
	7	8	2	4	3		10	1	2	8	5		5	3	11	9	9		9	6	4	4	9		3	8	7	2	5	
	9	2	6	10	1		2	6	7	9	6		8	11	5	4	7		8	11	2	2	11		9	4	2	4	11	
	1	1	8	3	4		12	7	1	10	2		7	8	9	7	8		5	3	9	11	4		8	7	3	12	10	
	10	9	7	6	12		9	12	6	5	8		11	12	4	2	10		1	7	12	9	7		4	6	1	7	12	
	4	6	3	5	10		1	11	3	2	10		9	2	6	6	3		7	9	11	8	2		5	10	8	8	7	
	12	4	11	1	5		8	4	11	7	7		4	6	3	5	4		12	8	10	7	3		1	9	10	11	1	
	2	10	5	12	11		5	10	5	1	4		3	5	7	10	12		10	4	8	10	6		6	5	5	10	2	
	3	7	4	9	8		11	5	4	6	1		2	7	10	3	5		11	1	1	1	5		12	3	6	6	9	
	11	3	10	7	7		6	9	8	3	11		12	4	12	11	1		3	2	5	6	8		2	11	11	3	6	
	8	12	1	11	6		7	2	12	11	9		1	1	8	1	6		4	10	3	5	1		10	12	12	9	8	
	6	5	9	2	2		3	8	9	4	3		6	9	2	12	2		2	12	7	3	10		11	1	9	5	4	
	5	11	12	8	9		4	3	10	12	12		10	10	1	8	11		6	5	6	12	12		7	2	4	1	3	

Diagram showing the arrangement of the potato varieties in the experimental plots. The numbers in the diagram refer to the different varieties as shown in Tables I and III, cols. 1 and 2.

Table II shows the total number and percentage of each variety which became infected with leaf roll as indicated by the development of secondary symptoms in 1938. It will be noted that in certain varieties such as Arran Pilot, Dunbar Yeoman and British Queen the proportion of primary leaf roll to total infection is low whereas it is high in the case of varieties Arran Cairn, Arran Peak, Dunbar Standard and President. The outstanding difference between these two groups of varieties is their date of maturity, Arran Pilot and Dunbar Yeoman being first earlies and British Queen a second early while all the varieties in the second group belong to the maincrop class. There appears, therefore, to be a connection between the date of maturity of a variety and its ability to produce symptoms of primary leaf roll which will be referred to later.

The outstanding variety in its susceptibility to the disease as shown by the development of secondary symptoms in 1938 is Arran Cairn. The other varieties with the exception of Arran Signet are significantly less so and these varieties show only small differences in susceptibility between themselves.

Reference to Fig. 4 will show that a drill of leaf roll sources occurred between every five drills of healthy plants. The latter drills were numbered 1W, 1E, 2W, 2E, 3, according as they were situated adjacent to, two drills away from, or three drills away from, the sources on the east or west side. As will be seen from Table II, the greatest development of the disease occurred in the drills adjacent to the sources, there was a considerable reduction in diseased plants two drills away while there was least leaf roll among the plants three drills away from the sources. This is borne out in general by the figures for the individual varieties.

A statistical examination of the figures gives the following results :—

Difference in amount of leaf roll in	1W	as against	1E	—Not significant.
„ „ „ „	2W	„	2E	— „
„ „ „ „	1E	„	3	—Significant at .01
„ „ „ „	1W	„	3	— „ „
„ „ „ „	2W	„	1W	— „ „
„ „ „ „	2E	„	1E	— „ „
„ „ „ „	2W	„	3	— „ .05
„ „ „ „	2E	„	3	—Not significant.

Therefore it may be stated that no significance is to be attached to differences in the number of plants which contract leaf roll in drills immediately on either side of the infected rows, nor in drills equidistant from infected rows. There is, however, a significant difference between the numbers of plants contracting leaf roll in drills at different distances from the source of infection, for example 1W as against 2W, 1E as against 2E.

Murphy and McKay (4) as a result of experiments on the extent of spread of leaf roll state that approximately 87 per cent. of all the infections that took place were confined to the first drill, 9 per cent. to the second and 3 per cent. to the third. While the writer's figures do not agree with these it is recognised that the extent of leaf roll infection will vary with conditions each year but the conclusion is the same, namely that the amount of leaf roll infection is considerably reduced in plants growing two or three drills away from the sources.

Experiments in 1938

In 1938 another set of twelve varieties was exposed to infection with the leaf roll virus. A list of the varieties used is given in Table III and the experimental plots were laid down in a manner similar to those in 1937 (Fig. 4). It will be seen that the varieties British Queen, President and Flourball were included in the tests in both years. This was done with a two-fold object, namely, to have a standard for comparison of symptoms in the newer varieties and for comparison of the amount of infection occurring in the two years during which the experiment was carried out.

President represents a variety in which the leaf roll virus causes very severe stunting accompanied by intense chlorosis and is also considered to be very susceptible to infection. In the case of Flourball, symptoms are not severe and loss of vigour is slight; it is also a variety which is resistant to infection with the leaf roll virus. British Queen is intermediate, in the type of symptoms produced by the leaf roll virus, between President and Flourball and is also considered to be intermediate in its susceptibility. As in the previous experiment, five tubers from each unit were planted for observation in 1939, the varieties being in separate plots. In all there were one hundred plants of each variety exposed to infection during each of the years 1937 and 1938.

Aphis Counts on Experimental Plots, 1938.—In 1938 initial infestation was earlier and heavier than in 1937. The weather during April and May was very warm and dry and conditions for migration of aphids were excellent. Cabbages examined in the garden, adjacent to the plots, in March showed apterous *M. persicae* present on the lower leaves of 6 out of 30 plants examined. At the beginning of April, the numbers of aphids present on the cabbages had increased considerably and nearly all the plants were infested, no alate forms being found, however. On May 12th, the cabbages were again examined and it was found that a large number of alate forms had developed on them. An examination on this date of the potato plants which were above ground in the plots adjoining gave an index figure of 25 *M. persicae* per 100 leaflets (compound leaves had not yet formed) and of these 16 were alate and 9 apterous forms.

It is likely that the initial infestation occurred some days prior to this

date as the apterous forms present had nearly reached the adult stage. Three days later the index figure per 100 leaves was 54 alate and 81 apterous *M. persicae* while the maximum number per 100 leaves of 63 alate and 155 apterous forms was reached on May 26th. There was a rapid decline in numbers after this date especially after the first week in June. This decline was mainly caused by the action of parasites and to some extent by the cold wet weather which occurred during June.

It is clear, therefore, that initial infestation of the potato plants by *M. persicae* was earlier and heavier in 1938 than in 1937 and that the maximum number occurred earlier in the former year. As will be seen later, this early and heavy infestation in 1938 was responsible for a considerable increase in the amount of leaf roll transmitted in that year compared with 1937. The extent of spread in 1938 is worthy of note because although infestation from the middle of June onwards was slight there was a considerable spread of leaf roll and this is considered to be due almost entirely to the heavy infestation which commenced early in May and continued until mid-June. This was to be expected for the following reasons—conditions for movement of winged aphids in this period were ideal, alate forms of *M. persicae* were present in comparatively large numbers, the potato plants were young and thus were more susceptible to infection and finally sources of leaf roll were plentiful in the plots.

TABLE III.

Development of Primary Leaf Roll, 1938

Variety No.	Variety	Number of plants showing primary leaf roll on		
		9th June (4 plots)	11th July (2 plots)	27th July (2 plots)
1	Arran Banner	0	6	17
2	„ Crest	0	2	9
3	„ Victory	1	10	21
4	Epicure	1	3	9
5	Great Scot	0	2	7
6	Kerr's Pink	0	14	32
7	Majestic	0	7	19
8	May Queen	1	1	5
9	Up-to-Date	0	6	26
10	British Queen	0	1	9
11	Flourball	2	4	12
12	President	1	10	28
	TOTAL ..	6	66	194

Development of primary leaf roll.—Table III shows the development of primary leaf roll in the varieties exposed to infection in 1938. It will be seen from the Table that there was a very early appearance of this phase of the disease, six plants were already showing symptoms on June 9th. It is reasonable to expect this when it is considered that alate *M. persicae* were present in relatively large numbers on the potato plants as early as May 12th and as already pointed out the initial infestation probably took place some days earlier. As the plants were very young at this time it may be concluded that the incubation period following infection would be short (5).

It was not possible to make observations on the development of primary leaf roll during August, while the figures for the occurrence of the disease in July are taken from observations made on two plots. It will be noticed, however, that the amount of primary leaf roll which developed from July 11th-27th is very much in excess of that which occurred prior to July 11th. Again, in the varieties British Queen, Flourball, and President, the amount of primary leaf roll which developed in the latter half of July, 1938, is far in excess of that which occurred for a similar period in 1937. This can be explained by the heavier infestation of the experimental plots by *M. persicae* which occurred in the former year.

TABLE IV.

Results of 1938 Experiment

Variety No.	Variety	(1938) Number of plants which displayed primary leaf roll in drill					Total P.L.R. *	(1939) Total number of plants which contracted leaf roll infection in drill					Total S.L.R. *	Per cent. S.L.R.
		1W	1E	2W	2E	3		1W	1E	2W	2E	3		
1	Arran Banner	7	7	0	1	2	17	10	15	4	3	2	34	37
2	,, Crest	5	2	1	1	0	9	14	13	4	5	3	39	41
3	,, Victory	7	7	2	2	3	21	18	17	4	4	3	46	52
4	Epicure	5	3	0	1	0	9	14	14	6	2	3	39	41
5	Great Scot	2	1	1	2	1	7	11	11	6	7	4	39	42
6	Kerr's Pink	11	10	3	5	3	32	19	16	5	7	6	53	54
7	Majestic	7	6	3	3	0	19	15	10	5	4	1	35	36
8	May Queen	3	1	0	1	0,	5	18	11	6	5	3	43	48
9	Up-to-Date	9	7	3	3	4	26	18	16	11	9	10	64	66
10	British Queen	4	2	0	3	0	9	19	15	8	9	3	54	56
11	Flourball	4	5	1	1	1	12	8	17	5	4	3	37	38
12	President	9	6	4	6	3	28	13	9	12	3	3	40	43
	TOTAL	73	57	18	29	17	194	177	164	76	62	44	528	554

*P.L.R. = Primary leaf roll.
S.L.R. = Secondary leaf roll.

Table IV shows the total number of plants of each variety which displayed primary leaf roll symptoms in 1938, also the total number which became infected as shown by the development of secondary leaf roll in the units in 1939.

The figures indicate that there are certain varieties which show a much lower proportion of primary to secondary leaf roll than others. Thus the earlies May Queen, Arran Crest, Epicure and the second early British Queen show little primary leaf roll while the maincrop varieties President, Majestic, Kerr's Pink, Arran Banner and Arran Victory show the opposite tendency.

It will be seen also from the totals in Table IV that the greatest spread of leaf roll took place to the plants in the drills immediately on either side of the sources, that is in drills 1W and 1E and that the spread to drills 2W and 2E is less than half this while the spread to drill 3 is reduced to about one-third. The figures have been tested statistically and confirm the results of the 1937 experiment for all findings with the exception that in the 1938 experiment there was found to be a significant difference between the amount of leaf roll in drill 2E as against drill 3.

The figures in Table IV also show that of the twelve varieties Up-to-Date is outstanding in its susceptibility to leaf roll. At the other end of the scale may be placed Arran Banner, Flourball and Majestic, the remaining varieties taking an intermediate position.

Comparison of results of 1937 *and* 1938 *Experiments.*—Taking the varieties British Queen, President and Flourball as the standard for comparison of the results in the two years 1937 and 1938 it will be seen from Table V that the relative susceptibility to leaf roll of the three varieties is approximately the same in the two years as shown in the development of the primary and secondary phases of the disease.

TABLE V.

Comparison of Leaf Roll Infection: 1937 and 1938 Experiments

Variety	Primary Leaf Roll		Percentage Leaf Roll Infection	
	1937 Experiment	1938 Experiment	1937 Experiment	1938 Experiment
British Queen	8 (4 plots)	9 (2 plots)	37	56
President	22 „	28 „	29	43
Flourball	11 „	12 „	22	38

By plotting the 1937 figures for percentage leaf roll against those for 1938 for the three varieties a straight line is obtained by means of which a comparison may be made of the results obtained for all the varieties used in the two years. If, therefore, the percentage leaf roll infection for the varieties in the 1937 experiment is transformed to the 1938 values figures are obtained as shown in Table VI. :—

TABLE VI.

Varietal Susceptibility to Leaf Roll (1938 Values)

Variety	Percentage Leaf Roll	Variety	Percentage Leaf Roll
Arran Banner	87	Arran Cairn	77
,, Crest	41	,, Peak	54
,, Victory	52	,, Pilot	56
Epicure	41	,, Signet	63
Great Scot	42	Dunbar Standard ..	41
Kerr's Pink	54	,, Yeoman ..	51
Majestic	36	Gladstone	53
May Queen	48	Redskin	41
Up-to-Date	66	Ulster Monarch	50
British Queen	56	British Queen	56
Flourball	38	Flourball	38
President	43	President	43

While it must be realised that the figures for percentage leaf roll will vary according to conditions in any year, nevertheless it is considered that the figures in Table VI are a good indication of the relative susceptibility of the varieties used in the test.

Effect of leaf roll on the yield of potato varieties.—In 1940 a preliminary experiment was conducted with the object of ascertaining the effect of leaf roll on the yield of a number of varieties. Twenty-three varieties were used and the experiment was laid down according to the plan as shown in Table VII. At time of digging, the end plants in the case of both the leaf roll and healthy lots were discarded and are not included in the weighings.

TABLE VII.

Arrangement of Leaf Roll—Effect on Yield Plot

Variety	Leaf Roll	Healthy	Drill
	Plants	Plants	
May Queen	26	30	1
Epicure	26	30	2
Arran Crest	26	30	3
British Queen	26	30	4
Great Scot	26	30	5
Kerr's Pink	26	30	6
Majestic	26	30	7
Flourball	26	30	8
President	26	30	9
May Queen	26	30	10
Epicure	26	30	11
Arran Crest	26	30	12
British Queen	26	30	13
Great Scot	26	30	14
Kerr's Pink	26	30	15
Majestic	26	30	16
Flourball	26	30	17
President	26	30	18
Arran Victory	26	30	19
Arran Cairn	26	30	20
Arran Pilot	26	30	21
Up-to-Date	26	30	22
Dunbar Standard	26	30	23
Arran Peak	26	30	24
Gladstone	26	30	25
Arran Signet	14	42	26
Arran Banner	14	42	27
Ulster Monarch	7	49	28
Eclipse	9	47	29
Redskin	14	42	30
King Edward	9	47	31
Dunbar Yeoman	8	48	32

TABLE VIII.

Results of Yield Test, 1940

Variety	Leaf Roll: No. of Leaf Roll Plants *	Leaf Roll: Total Weight	Leaf Roll: Weight per Plant	Healthy: No. of Healthy Plants *	Healthy: Total Weight	Healthy: Weight per Plant	Percentage Loss in Weight
		lb.	lb.		lb.	lb.	
May Queen ..	41	10¾	0.26	54	115.25	2.13	87.80
Epicure	45	27½	0.61	56	115.25	2.05	70.25
Arran Crest ..	34	9¾	0.28	54	104	1.92	85.42
British Queen ..	46	71	1.54	53	178.5	3.36	54.13
Great Scot ..	48	63¼	1.32	56	139.5	2.49	46.99
Kerr's Pink ..	42	48¼	1.14	56	135.25	2.41	52.70
Majestic	46	59¼	1.28	49	139.25	2.48	48.39
Flourball	46	69½	1.51	57	122.5	2.14	29.44
President	35	2¾	0.08	56	135	2.41	96.69
Arran Victory ..	24	38¾	1.61	28	91.5	3.26	50.25
Arran Cairn ..	24	28¾	1.19	28	127.25	4.54	76.00
Arran Pilot ..	24	9¼	0.38	28	72.25	2.58	85.28
Up-to-Date ..	24	59½	2.47	27	113.25	4.20	41.20
Dunbar Standard ..	24	25½	1.06	28	111.25	3.97	70.79
Arran Peak ..	24	34¾	1.44	28	89.5	3.19	54.86
Gladstone	24	31¼	1.30	28	88	3.14	58.60
Arran Signet ..	10	5¼	0.52	39	123.5	3.47	85.02
Arran Banner ..	11	18	1.63	39	165	4.23	61.47
Ulster Monarch ..	5	3¾	0.75	40	91.5	2.28	67.11
Eclipse	6	9¾	1.62	44	175.75	3.99	59.40
Redskin	10	5¼	0.52	40	107.5	2.68	80.60
King Edward ..	6	¼	0.04	15	44	2.93	98.64
Dunbar Yeoman ..	6	2	0.33	18	49.5	2.75	88.0

*Variation in numbers of leaf roll and healthy plants as between Tables VII and VIII is due to misses which occurred in the drills.

The results which are shown in Table VIII indicate that there is a fairly wide variation in the effects of leaf roll on the yield of different varieties. Thus in King Edward, President, Dunbar Yeoman, May Queen and Arran Crest, leaf roll has the effect of considerably dwarfing the plants, there is extreme loss of green colour and the yield is accordingly much reduced. In the case of Flourball symptoms are not severe, nor is the yield seriously reduced. Up-to-Date and Great Scot are examples of varieties in which the effects of leaf roll are moderate, there is no extreme stunting or yellowing of the plants and the yield is not unduly depressed.

DISCUSSION

The results of the two years' experiments show that even when vectors and sources of leaf roll are present in a potato crop in fairly large numbers, there is nevertheless a significant difference in the extent of spread of the disease to healthy plants growing at varying distances from the source of infection. It has been shown that healthy plants growing adjacent to the source are more likely to become infected than those growing one or two drills away. The conclusion that may be drawn from this fact is that in any single potato crop the main vectors of leaf roll are the apterous aphids, since it is reasonable to expect that plants infected by alate forms would be scattered rather indiscriminately throughout the crop. From what is known of the habits of alate *M. persicae* in early summer, it may be concluded that these forms occur mainly to reproduce and spread the species over as large an area as possible in a short period. These winged aphids, therefore, are extremely active and under suitable conditions it is probable that their stay in any single potato crop would be short. The apterous forms on the other hand, on account of their limited powers of movement due to the absence of wings, would remain throughout their whole life within the crop on which they were produced and for the same reason would be more likely to infect healthy plants growing close to the source from which they obtained the virus than plants growing further away.

As regards the development of primary leaf roll in the different varieties used in the experiments, it has already been pointed out that early varieties show less primary leaf roll in proportion to total infection than do varieties in the maincrop class. This difference may be explained by the difference in the time of maturity of these two classes. Early varieties as the name implies prout and make fairly rapid growth early in the season, so that by the time aphids are plentiful on the potato crop plants of these varieties have reached full size and the incubation period is therefore prolonged, also since they mature early, the period between infection with leaf roll and maturity is relatively short thus limiting the amount of primary leaf roll likely to develop. The later sprouting of maincrop varieties on the other hand and the longer growing season after possible infection facilitates the development of primary leaf roll symptoms.

INDEX—VOLUME XXXVII.

PAGE

PAGE

DEPARTMENT OF AGRICULTURE

JOURNAL

VOLUME XXXVIII.

INDEX

DUBLIN:
PRINTED FOR THE STATIONERY OFFICE
BY THE CHAMPION PUBLICATIONS LTD., SLIGO.

CONTENTS

THE NEED FOR INCREASED AGRICULTURAL PRODUCTION IN THE PRESENT EMERGENCY.

Broadcast from Radio Eireann on Tuesday, 31st December, 1940,

by

THE MINISTER FOR AGRICULTURE.

At the present moment when men are debating the most effective measures for the defence of their country it is important to remember that one of the very urgent questions is that of food supply. I want to stress the gravity of the situation in regard to *our* food supplies. The position is gradually becoming more serious and it is quite possible, if not probable, that within a very short period supplies of imported food may be cut off entirely.

With this in mind the Government had no alternative but to amend the Tillage Order increasing the area required to be cultivated in 1941 from one-sixth to one-fifth of the arable land on each holding comprising ten or more statute acres of such land. Faced with a situation so menacing it must be obvious to everyone that the question of increased food production is of the first importance, outweighing every other problem which confronts us at the moment.

When speaking in the past I hesitated to sound an alarming note in regard to supplies of foodstuffs for human and animal use. The time for hesitancy is past. I now wish to say quite positively that if our people are to survive the dangers which lie ahead all essential foods must be produced *at home*.

On more than one occasion in the past I have said that in normal circumstances I would not favour the adoption of compulsion in the matter of food production. My views have not changed and I have not abandoned the expectation that, given reasonable encouragement, the farmers of this country will respond to the appeal to produce in the year 1941 the additional food required to render us independent of imported supplies. That is why an increase in the guaranteed price for wheat was announced at the same time as the amendment of the Tillage Order. I am confident that the farmers of this country will, apart from any Tillage Order, co-operate whole-heartedly in ensuring that the maximum amount of food is produced in this fertile country. There will always be a minority, however, who will remain deaf to appeals on behalf of the country and callous to the danger of hunger in their own and their neighbours' families. For these compulsion is necessary. They will have to till 20 per cent. of their arable land and if they have not

made sufficient progress by the middle of February I am empowered to take over the land and have it tilled. While I have no wish to interfere unnecessarily with any farmer I want to warn the dilatory that the Nation's needs are too acute to allow me to be indulgent. And so I leave to their fate those who must be driven.

I turn again to the majority, the great majority of farmers, and I ask them to take steps at once to ensure that adequate supplies of food for our people will be forthcoming. Wheat, sugar beet and potatoes are of primary importance. Oatmeal for porridge and malting barley are also required.

Bread is the staple food of all peoples and wheat is the basis of bread. Every country in the world endeavours to safeguard its wheat supplies and we have not been backward in this connection. While our farmers have responded loyally to the appeal for increased production of wheat and while the area under this crop has increased within the last decade from approximately 20,000 to over 300,000 acres we are still dependent on imported supplies for more than half our requirements.

One may well ask is there any good reason why we should not grow all the wheat we need ? My answer is no. Less than a century ago this country grew over 600,000 acres of wheat annually. Surely in these times with modern farm machinery and equipment farmers should be capable of doing what their forefathers did, especially when regard is had to the fact that there is now an assured market and a guaranteed price of 40s. for every barrel of millable wheat produced.

Some years ago there was a general impression that wheat could be grown successfully only on the better class soils. Experience of recent years has shown this to be a fallacy. Good crops of wheat have been secured in almost every district in the country and there is scarcely a farm throughout the length and breadth of the land on which wheat cannot be grown with reasonable success.

If ample supplies of artificial manures were available I would have no fears for returns on the poorer soils. The enhanced price guaranteed for the crop, on the other hand, should at least make up for any reduction in yield due to a possible shortage of fertilisers.

Winter wheat can with safety be sown everywhere in this country up to the end of February. Ample supplies of first quality seed of winter varieties are available, while we cannot guarantee an unlimited supply of spring seed. Consequently, farmers who propose to sow wheat—and I hope every farmer will—should get the crop in at once. Farmers who have already sown wheat should, because of the gravity of the situation and in view of the enhanced price, increase their acreage under the crop. I would appeal to every farmer

then, in the first place, to grow enough wheat for his own household. After next harvest he will thus have cheaper, better and more wholesome bread on his table. Having secured himself and his family against want he should grow as much as he can for sale. Remember there is a guaranteed market at a guaranteed price. The farmer who grows more wheat is, therefore, a good father and a good Irishman.

The potato has long been regarded as a staple article in the diet of our people. Nevertheless it is doubtful if its true value as a human or animal food is fully appreciated even in this country. Acre for acre potatoes produce at least twice as much human food as any of the cereals and potatoes are included as one of the most important items in the principal meal of every family in the country. Moreover, the crop can be fed to all types of farm stock and it has been proved that for this purpose 4 tons of potatoes are the equivalent of one ton of maize meal. An increase in the acreage is, therefore, an obvious means of meeting a shortage of human and animal foods. Equally desirable is the proper care and storage of potatoes particularly against winter frosts, the economical use of table potatoes and the reservation of supplies of seed for the planting of an increased acreage in 1941.

The oat crop is no less important. When it is realised that almost 700,000 acres of oats were grown in this country last season ; that oats are capable of being utilised to a considerable extent for human consumption and that the grain can be fed to every class of farm animal, the importance of the crop as a feature of our national economy cannot be over-emphasised.

Since it is unlikely that any maize will be available in the coming year, and since it is essential that our production of milk, butter, bacon and eggs should be maintained the acreage under oats during the coming season must be further increased if our live stock are to be properly fed.

The growing of barley has hitherto been confined more or less to special districts but there is no reason why the crop should not be more extensively cultivated. Whilst all soils may not be capable of producing first-class malting barley, crops eminently suitable for feeding purposes can be grown in practically every district. Barley is the ideal substitute for maize especially for pig feeding and if our output of pork and bacon is to be maintained adequate supplies of barley for blending with oats are a necessity.

The shrewd farmer knows that before long there will be no imported feeding stuffs for his animals. He knows that wheat being scarce the millers must extract more flour from it and leave less offals behind. He sees that he must, therefore, grow all his own feeding stuffs and he makes up his mind to increase the area under potatoes, oats and barley. He will also see that our leanest period will be the period immediately before next harvest. He

can anticipate this to some extent by growing more potatoes, because they will be available for use two months before the grain crops come in.

It must be borne in mind that the great bulk of the farmers' produce is grown for use on the farm, mainly in the feeding of live stock. This applies particularly to the root and forage crops. Moreover, the sale of these crops through the medium of animals and animal products is the best and most economical method of disposing of them. If farmers, therefore, are to maintain the present system it is absolutely necessary that the maximum amount of roots and kindred crops should be raised in the coming year.

On a number of occasions recently reference has been made to the facilities offered by the Government for the provision of allotments during the 1941 season for both the employed and unemployed. I do not want to repeat what I have already said, except to mention that the amount of food capable of being raised in small gardens and allotments is, in the aggregate, of considerable dimensions. The occupier of a small garden or an allotment can, therefore, contribute his quota to the Nation in the existing emergency.

In their efforts to respond to the appeal for increased food production many farmers are handicapped by the temporary shortage of artificial manures. This, however, is not the only difficulty that has to be overcome and while adequate supplies of artificial manures are important there is no reason, in their absence, why the programme for increased food production should not be brought to a successful conclusion. It should not be forgotten that even in normal times many farmers in this country used artificial manures only to a limited extent. Neither can we overlook the fact that less than a century ago, before artificial manures were known, the area under crops was double what it is at present.

In this emergency men and women of all ages and stations have offered to work for the common good. Some have joined the Army, some the L.S.F., some have trained in A.R.P. work, some in fire fighting, and some in nursing and first aid, and some have even offered to revive the wounded with their blood. In all these organisations there are men and women from the land. More tillage may be more troublesome, or indeed it may appear unneccessary but I would ask all to think of the common good.

The farmer can serve the common good first by growing enough wheat, potatoes and oats for his own household; secondly by devoting as much land as he can to wheat for sale, and thirdly, by making his farm absolutely self-sufficient in the provision of feeding stuffs for his stock.

Finally I appeal to every farmer to think it over. If he does he can only come to one conclusion and that is to till all he can. He will be a good Irishman when he thinks of his country's needs and he will be a shrewd farmer when he thinks of his own economy.

(Issued as Special Leaflet No. 11).

FOOD PRODUCTION IN THE EMERGENCY.

With the co-operation of the Director of Broadcasting, the Department arranged a series of broadcast talks which were given from Radio Eireann during the early months of 1941. *The texts of the first three of these broadcasts are included in this number of the* JOURNAL.

(1) Broadcast Talk, entitled "MORE AND MORE WHEAT," given by MR. T. O'CONNELL, Chief Inspector, Department of Agriculture, on 6th January, 1941,

In his broadcast of a week ago the Minister for Agriculture told his listeners of the alarming position in which, arising from shipping difficulties, we find ourselves in regard to supplies of foodstuffs for human and animal consumption. He desires me to emphasise the fact that there is a wide gap between our production of essential foodstuffs and our normal requirements and that unless this gap is bridged by increased home production in the coming season, the shortage of animal feeding stuffs next winter will be so serious as to cause a decrease in the output of live stock and live stock products so alarming as to endanger our whole economy. Not only this but what is still more serious, that the human population, and particularly those who have no means of producing food on their own account, may suffer grievous hardship because of shortage of bread materials.

Any and every form of increased food production is welcome, but that which caters for human consumption must have pride of place. We grow annually almost three-quarters of a million acres of oats, yet we have never favoured the highly nutritious oaten bread so commonly used by people elsewhere. Rye could be grown in many districts unsuited to wheat or oats, but the wholesome, although perhaps unattractive-looking, rye bread commonly used in Northern Europe would not be at all popular here. We have, in short, become heavy consumers of wheaten bread and in fact demand a whiter flour than is used elsewhere. In other words, a flour from which some of the most valuable mineral and other ingredients have disappeared with the outer layers of the wheat grain, to become the bran and pollard which constitute milling offals. It is poor consolation to reflect that the loss of ingredients which are indeed particularly valuable in the diet of our growing children are recovered in the consumption of mill offals by our farm animals.

Circumstances may induce us to accept a substitute for wheaten bread,

but normally to our people as a whole wheat sufficient to produce our total bread requirements has become a virtual necessity.

Because of this, and also because we are now at the height of the wheat-sowing season, this talk is devoted to wheat, to the exclusion of other food-producing crops, which other speakers in this series will deal with later.

For the current cereal year ending on September 1st, home-grown wheat is available to provide about 40 per cent. of our flour requirements at normal extraction, apart from grain used as seed and directly for whole meal manufacture by growers. The total is equivalent to about five months supply, which compared with less than two weeks supply a few years ago represents no mean performance on the part of our farmers. The deficit is equivalent to the produce of some 350,000 acres, and it is in the confident hope that the 1941 wheat crop will go a long way to meet this deficit that the recently announced price of 40s. has been offered for every barrel that can be produced.

So far as it is humanly possible to do so the Legislature has provided against the effects of bad harvest weather by placing flour millers under certain legal obligations in regard to the drying and storing of home-grown wheat. It is, however, no longer necessary to exercise the powers so conferred for Irish millers are now only too willing to purchase their quotas and no grower need fear difficulty in disposing of millable grain—immediately after harvest—if he so wishes.

Soil.—Any doubts regarding the suitability of our soil and climate for the growing of wheat have been dispelled by the experience of the past five years. I have before me figures showing the wheat acreage in each county during the past season. The crop was grown successfully in every county from Cork to Donegal, but the figures show that the tillage counties have contributed the largest area. Incidentally they show that in some of these counties, notably Kerry, Louth and Offaly, larger areas were devoted to wheat in 1940 than when wheat growing was at its peak a century ago and that Cavan, Cork, Laoighis and Carlow are within measurable distance of the areas similarly grown in these respective counties. This does not mean that there is no further room for expansion in these and other tillage counties, in fact it is confidently expected that once again the voluntary contribution of the tillage farmers will be the biggest factor in the present food crisis. Other old-time wheat-growing counties have a lot of leeway to make up and in some of the grazing counties the bulk of the land inherently suited to wheat growing has not yet been touched.

Much of this land has been in pasture for generations and has accumulated a vast store of fertility. Similar land ploughed from lea during recent years has yielded excellent crops of wheat, not only in the first season but usually

better crops in the second, while in some cases a satisfactory third crop has been taken, with the aid of artificials, before the introduction of a manured root crop. Fertility will naturally be reduced by such treatment and the ancient sward, beloved of cattlemen, for the time destroyed. If the Nation decrees that such lands must in the future contribute their quota of tillage crops, they will still be higher in fertility than most soils in the tillage counties. If it decrees otherwise, the replacement of fertility and the restoration of so-called ancient pasture do not present nowadays anything like insoluble problems. With the return of normal times, two or three annual dressings of properly balanced artificials will work wonders in the former direction, while the use of a proper grass seed mixture will produce in a comparatively short period, a more nutritious pasture than the old. In any event, these rich grazing lands owe a debt to the Nation which can never be more opportunely liquidated.

Certain precautions are necessary in the preparation of old pasture land for the growing of wheat. The most important are early ploughing and a firmly packed sod. Others are mentioned in the Department's Special Leaflet No. 1 " Growing Wheat on Lea or Bawn."

Almost at the other end of the scale from the rich grazing lands are the lighter soils in the less fertile tillage counties, the soils which those who do not believe in the revival of wheat growing would describe as suited only to oat growing; the soils for example on which shrewd Co. Cork farmers grew 59,880 acres of wheat in 1940 and on which their similarly " misguided " brethren in Laoighis grew 22,600 acres. On these soils the regular rotation includes a manured root crop, introduced between two grain crops, and no farmer in these areas now doubts the capacity of his land to produce wheat as one of these grain crops—preferably following manured roots or potatoes.

It would be useless to expect wheat growing on any considerable scale in the poorer portions of the counties comprised in the Congested Districts, but even in these areas there are favoured localities where plots of wheat may be grown for home use as whole meal. This has been demonstrated over a number of years by large scale wheat plots grown under the supervision of the Department's Agricultural Overseers and wheat growers in this category will get every possible encouragement during the present season.

There is, therefore, practically no area in the country where wheat may not be grown to some extent and no scarcity of land suitable to produce a much greater proportion of our requirements.

Time of Sowing.—At the present time one can see in many parts of the country early wheat crops sown in October and November and now forming splendid brairds. These crops will normally ripen earlier than crops of winter

varieties sown from now onwards but this need not deter new growers. Early sowing is desirable and represents a job already done, but winter wheat may be sown in this country with perfect confidence up to the middle of February and even to the end of that month. Many of the finest crops of Queen Wilhelmina and similar varieties grown in 1940 were in fact not sown until the end of February and early March. Late sowing of winter types naturally results in later ripening and as we cannot expect a regular recurrence of the harvest weather of 1940, growers who have not yet sown their crops should aim at doing so, preferably during this month of January, or if possible not later than mid-February. After the end of February the less satisfactory spring varieties must be substituted.

Varieties.—On the question of Winter varieties it is difficult, for general cultivation, to improve on Queen Wilhelmina. This, or one of its variants such as White Stand Up, Juliana, Victor, etc., occupied the largest proportion of our wheat area in recent years and they have given general satisfaction. On the richer soils and particularly after the old lea previously referred to, where lodging is liable to occur, the more recently introduced variety—Pajbjerg—should be used. After Pajbjerg, Yeoman should get preference over others. On soils of less than average fertility the old reliable Squarehead Master can scarcely be improved on as a winter wheat.

All of these varieties were grown here during the past season, and many farmers have reserved seed partly for their own use and partly for sale. Many seed merchants have also assembled stocks which have been thoroughly cleaned. These are in every respect equal to the best imported stocks of similar varieties and considerably cheaper. All home-grown seed is in fact of excellent quality this season and failure to sow winter wheat will certainly not be due to shortage of seed.

Wheat growers are now fairly familiar with spring varieties. Except in a limited number of districts these are not greatly favoured, nor are they as a whole nearly as dependable as winter types. They are generally more adapted to light land, but growers elsewhere who cannot sow winter wheat in time need not hesitate to substitute the spring variety best suited to their particular conditions. The spring varieties usually grown here include Red Marvel, April Red, and in latter years, two Swedish varieties, Diamant and Atle. They—and also the winter varieties mentioned—are fully described in the Department's Leaflet on Wheat Growing—No. 61. Growers have been advised to reserve seed of these spring varieties and seedsmen have also assembled stocks which like the winter varieties are of first-class quality. It is anticipated that some imported seed of spring varieties will also be forthcoming, but it is highly probable that there will still be a scarcity. **Under no circumstances, therefore, should any farmer who can sow winter wheat defer doing so now with the intention of substituting a spring variety later on.**

A wheat recently introduced which is not described in the Department's leaflet is worthy of mention inasmuch as it is the nearest thing to a winter-spring variety. This is the French variety " Desprez " which can be sown from October to early March, which ripens early, yields well, and does not lodge, even on the most fertile soils. I can almost hear somebody say: " Just the thing we want " but there's a snag in the form of susceptibility to Yellow Rust. The extent of the infection appears, however, to be related to the physical rather than to the chemical condition of the soil and the variety did quite well last season in open rich soils. Some seed of this variety is held by merchants, and farmers on good well-drained land who have not previously grown it should discuss the matter with their Agricultural Instructor.

Manuring.—Occasionally, and notwithstanding accumulated fertility, a cwt. or two of a phosphatic manure stimulates in the early stages wheat sown after the old rich pastures already referred to, but, generally speaking, the necessity for artificial manure on such lands may, in these times, be dismissed. The same applies to a second wheat crop on these lands which I am assured has, where grown, usually proved the better of the two.

On the good tillage lands wheat grown after a crop treated with farmyard manure, similarly, can do without artificials, but a second crop will benefit greatly from a few cwt. of phosphatic manure and two $\frac{3}{4}$ cwt. dressings of sulphate of ammonia applied about mid-March and early May, respectively. On very light tillage soils similar treatment is desirable even after a manured crop but in the absence of phosphatic and potassic manures two light dressings of sulphate of ammonia at the intervals already mentioned might be given. The use of sulphate of ammonia must not be overdone, particularly in the absence of phosphates and potash and it should be remembered that dressings of nitrogenous manures applied too early in the season favour mainly the growth of straw, and late dressings, the more desirable development of grain.

The position regarding the supply of artificials has been explained on more than one occasion recently, but it may be re-stated.

Briefly it is that potash manures which normally come from the Continent cannot now be imported. They can be replaced for mangels and sugar beet by agricultural salt and for all crops by seaweed where this can be procured. Certain potash reserves which the Fertiliser Manufacturers fortunately held will be incorporated in compound manures suited for tillage crops and particularly potatoes. For other farm crops, not even excepting potatoes, where farmyard manure is available, the absence of potash manures for a year or two can be borne without serious results.

Rock phosphate for manufacture of superphosphate comes in normal

times from Mediterranean countries and when the reserves held from last season were used up supplies had to be sought elsewhere. Great difficulty has been experienced in procuring them, but already 25 per cent. of last year's supply of superphosphate has been issued by manufacturers, plus a considerable proportion of last year's consumption of compound manures and as the season advances further supplies will be forthcoming.

A large proportion of our requirements of sulphate of ammonia is already in the country and it is anticipated that current demands will be met as the season advances.

While therefore artificial manures will be shorter than usual this season wheat growers whose crops really require a dressing of these manures should be able to procure the necessary supplies of superphosphate or compound manures and of sulphate of ammonia.

All growers might bear in mind that wheat growing and liming have old associations and although the heavy dressings of 20 to 30 barrels per acre formerly used did much damage to wheat land, a dressing of half-a-ton of slaked burnt lime—scattered with the shovel from a farm cart—will not fail to do good, even on rich soils.

Reasonable supplies of artificial manure should also be available for other tillage crops, if farmers will reserve for these crops such supplies of superphosphate and compound manures as they can procure and refrain from using them on grass land and for lea oats on land in good heart. Supplies of phosphate continue to arrive and further deliveries will be made before the time when artificials will be really required and indeed *before the date at which there would be any demand if supplies were abundant.*

In any event, all those concerned have done and continue to do their utmost to secure adequate supplies but they cannot achieve the impossible. The difficulty, and particularly with phosphates, is *not* that the material is not available in places other than the old sources of supply, but simply that ships to transport it cannot be chartered. No amount of criticism can alter this fact.

There is, however, one purpose for which the Department has deemed it imperative to secure an adequate supply of artificial manure, namely, for the allotments provided for unemployed persons under the 1926 and 1934 Acts. This has been made possible through the courtesy of The Irish Fertiliser Manufacturers Association and no unemployed plotholder need fear that he will not get the necessary quantity of a suitable compound free of charge.

(Issued as Special Leaflet No. 12).

(2) Broadcast Talk, entitled "THE IMPORTANCE OF THE POTATO," given by DR. H. KENNEDY, Secretary, Irish Agricultural Organisation Society, Ltd., on 18th January, 1941.

The dire calamity of war waged by sea and air all round us has already given some rude shocks to our ways and habits of life. Even now many of the things which we have taken for granted as being always available for our use or enjoyment have grown scarce. Some are already unobtainable, others may be unobtainable before many months have passed. We are being driven to concentrate on life's necessities and of these the first is food.

In these talks it was fitting that the first should be devoted to the production of wheat so that what has come to be regarded as "the staff of life" may be provided and that the feeding of our people may be safeguarded without too violent a change in food habits. But bread was not always "the staff of life" for the great majority. There will be some in my audience whose memories can go back to the time when the potato held that position and if by any mischance of unfavourable weather conditions at seeding or harvest the wheat crop were jeopardised, there need be no misgivings as to food requirements if an adequate acreage of potatoes is grown this spring. Even to-day the potato occupies a very important place in the provision of our food.

While at one time the potato was regarded to some extent as the symbol of poverty, as to its value as a food there can be no question. It is primarily a starch or energy-producing food. In addition, it is an important source--in some Northern countries the main winter source—of Vitamin C. It needs to be balanced with meat or milk and green vegetables. All accounts agree on the physical perfection of the race of which the main food was potatoes and milk. The standards have certainly not been improved by over-reliance in these days on a diet of impoverished white bread and tea. Arthur Young, that shrewd and impartial observer, who travelled this country in 1776, speaking of the food of the people, potatoes and milk, says: "I have heard it stigmatised as being unhealthy, and not sufficiently nourishing for the support of hard labour: but this is very amazing in a country, many of whose people are as athletic in their form, as robust, and as capable of enduring labour as any upon earth . . . . When I see the people of a country in spite of political oppression with well-formed, vigorous bodies, and their cottages swarming with children; when I see their men athletic and their women beautiful, I know not how to believe them subsisting on an unwholesome food."

The potato is a native of South America, and was introduced into Europe at the end of the sixteenth century. It developed in Ireland as a common crop far earlier than in any other European country. There were two reasons for this—the extraordinary suitability of the potato to our humid climate, and the fact that in the seventeenth century when the country was ravaged by war, it was about the only food material that could not be destroyed. It

was the main food of the people in the eighteenth and the greater part of the nineteenth century. If the need arises, it can once again preserve our people from hunger in a period of crisis. It is significant that Great Britain—not normally a great consumer of potatoes—should give a foremost place to that crop in its war tillage programme.

I have stressed the importance of the potato as the second line of defence against hunger and I appeal to farmers to see that that second line of defence is strengthened by growing a greater acreage and better crops of potatoes, so that no citizen of our State may be without adequate food, even under the most adverse circumstances.

But the potato, more than any other cultivated crop, has another function to fulfil—namely, the maintenance of our agricultural production, especially of pigs and poultry. We are deprived of the maize which we used to import. Even if, as we all hope, all the necessary wheat will be available, there will be less offals on account of the higher extraction of flour. If, therefore, production is to be maintained it can only be done by home-grown foods and of these the most important is the potato. The potato can be used for every animal on the farm but the pig especially uses the potato with great efficiency in the production of meat.

There is no country in Europe, and possibly none in the world so suitable as this to the culture of the potato. It occupies a greater percentage of the ploughed land in this than in any other country. Since 1851 the acreage under potatoes has decreased less than the acreage of any of the other major crops. These are sure signs of the realisation by the farmer of its special significance in Irish Agriculture. Almost 60 per cent. of the crop is normally used for animal feeding, an amount about equal in food value to the maize imported, so that already much of our agricultural output is based on the potato. In the years 1927-1931 the yields in the Department's variety tests all over the country—the crops being Kerr's Pink in the first two years and Arran Banner in the other three—averaged 15 tons 6 cwt. per statute acre. These results show what can be done in the ordinary farming practice. Crops of over 20 tons per acre have been obtained again and again in many districts. A crop of 12 tons to the acre is equivalent to 3 tons of maize—and it is no exaggeration to say that that yield can be obtained by proper husbandry on practically every type of cultivable land in this country. There is no other crop which can give such yields of food nutrients per acre for man or beast on practically every variety of soil. Even when Wakefield wrote in 1812, referring to a district in Co. Limerick, he states that "it was estimated that an acre of potatoes will make a ton of pork."

In the year 1938 we imported 350,000 tons of maize, largely for pig-feeding. As one ton of maize is equivalent to 4 tons of potatoes, to replace the maize there would be needed an extra 1,400,000 tons of potatoes. At 12 tons per

acre this would require approximately 120,000 extra acres; and at 8 tons per acre, 175,000 acres. Even at 8 tons per acre, the replacement of the maize would only involve an average of an extra half-acre of potatoes per farm in the country.

The food requirements of a 2 cwt. pig, including the proper proportion of the food of the sow from the time of service till the bonhams are weaned can be provided by 40 gallons skim-milk, 56 lbs. meat meal, 2 cwts. of cereal meal and 22½ cwts. of potatoes. If adequate milk is available the meat meal can be replaced by a further 100 gallons of skim-milk. For the production of the fat pig, therefore, only 2 cwts. of meal are necessary. The pig is an accommodating animal and the meal can be provided by one cwt. of crushed oats and one cwt. of pollard, or barley meal. Even in the event of pollard and barley meal not being available, the requirements can be fairly well satisfied by finely ground oats. A farmer can produce 8 pigs on 9 tons of potatoes, 320 gallons of skim-milk, 4 cwts. of meat meal and 16 cwts. of cereal meal. With the exception of the meat meal and skim-milk that food can be provided on about three-quarters of an acre of potatoes, assuming a 12 ton crop, and a further four-fifths of an acre of grain, assuming a ton to the acre—or on a total of slightly over 1½ acres. Even with an 8 ton per acre crop the food can be produced on less than 2 acres. There should be no reason whatever to view with alarm the absence of maize meal in connection with the maintenance of our pig production.

Potatoes have some disadvantages as against maize meal. In the first place, the pig cannot assimilate adequate quantities of potatoes on account of their bulk to make quick enough gains. Hence the need for supplementing the ration with meals. Experiments carried out in Germany about 15 years ago, however, have shown clearly that satisfactory gains can be ensured with even as little as 1½ lbs. of meal per day in addition to the necessary protein supplement of meat meal or skim-milk and as much potatoes as the pigs will eat. This system of feeding was carried out last winter with the most satisfactory results by Mr. McGuckian in his well-known pig enterprise in Cloughmills, County Antrim, where he fed 40 tons of potatoes per day to his pigs, and about 7,000 tons in all. It is the so-called Lehmann system of pig-feeding from the German scientist who carried out the experiments. The system is not very different from traditional practice on our small farms where potatoes were abundant, but where money to buy meal was scarce. The use of potatoes to replace up to two-thirds of the meals has been thoroughly tested on the Department's farms.

Probably one of the reasons for the great popularity of yellow maize in the past and the preference given to it by farmers over other cereals is its content of Vitamin A, which is absent in potatoes—but is equally absent in white maize, barley, oats and mill offals. It can easily be replaced—and it is important to replace it—by fresh grass, green cabbages, kale, etc. Finally,

potatoes are poor in minerals and a suitable mineral mixture should be provided.

Poultry, as well as pig production, is jeopardised by the impossibility of importing maize, and here, too, the potato can play an important part in maintaining production. At least one-half by weight of the ration can be provided from potatoes without reducing production. The value of the potato for other farm animals is too well known to need emphasis. Potatoes suffer from the disadvantage of loss in storage in the late spring and associated with this is the labour of turning the potatoes. This problem can be solved where there are suitable facilities for cooking. The potatoes are well washed, cooked and packed tightly into a simple rectangular concrete silo. The closely packed mass is covered with sacks and a layer of clay to exclude the air. The potatoes treated in this way will keep indefinitely without deterioration of feeding value. They are available the whole year round and can be fed direct from the silo. This is now and has been for a number of years common practice in Germany, where simple plants consisting of washer, boiler and cooking vessels travel from farm to farm to cook the potatoes. The process has been tested and demonstrated on the Department's farms, and is described in the Department's special leaflet No. 9.

To grow potatoes with profit for pig and poultry production everything depends on getting large yields per acre. This again depends on good cultivation before and after sowing, on good seed, on the use of high-yielding varieties, such as Arran Banner and Kerr's Pink, on adequate manuring and on spraying early, spraying well, and spraying at least twice in the season.

Good seed is of primary importance. Seed may contain the sources of leaf roll and mosaic diseases which make it impossible to produce a good crop. A mere change of seed is useless unless the new seed comes from healthy stocks. Nowhere are better seed potatoes grown than the certified seed produced in this country. If certified seed is not available, the object should be to get seed grown from certified stocks, or as near to certified stocks as possible.

The ideal manurial dressing for potatoes is about 15 tons of farmyard manure supplemented with 4 or 5 cwts. of superphosphate, one cwt. of muriate of potash and one to two cwt. sulphate of ammonia per statute acre. Muriate of potash is not obtainable this season, but compound manures containing potash are available in reasonable quantity and 5 or 6 cwt. of one of these will replace the superphosphate and muriate of potash. While muriate of potash is desirable it is by no means indispensable and farmers who can apply about 15 tons of farmyard manure, 4 to 6 cwt. of superphosphate and one to two cwt. of sulphate of ammonia, may confidently expect yields not less than the comparatively moderate one of 12 tons already mentioned. Indeed if he has to do entirely without phosphatic manure for

the whole or portion of his potato crop, he can still get good yields from 15 tons of farmyard manure and 2 cwts. of sulphate of ammonia per statute acre.

In urging farmers to extend the acreage of potatoes and to grow heavier crops I have no mental reservation whatsoever, for it is and has long been my personal view that pig production can be carried on with more profit to the farmer in this country in peace or in war on the basis of potatoes than on the basis of imported maize. I ask especially those farmers, and they are the majority, who operate their farms with family labour. What is the added cost of growing another acre of potatoes ? The added cost is the seed, the manures, the spraying materials, and the acre of what in too many cases is very indifferent grass. A 12 ton crop of potatoes equal to 3 tons of maize can be got by way of added cost at a fraction of the cost of maize.

In my view, it is good business to grow a greater acreage and better crops of potatoes. In these anxious days it is good citizenship to safeguard the food of the people by increasing the production of potatoes for direct consumption, if the need should come, and for the production of meat and poultry products to give variety and balance to our food resources and to maintain the flow of trade, which is essential to our economic life.

The farmers of this country have never failed in service in the many dark hours of our troubled history. This nation is faced with the stern reality of having to rely on itself for its food supply. On you, farmers, the security of that food supply depends. The need is urgent and the time is short. Grow more wheat—but grow another acre of potatoes on every farm. Its generous harvest will banish the spectre of hunger and want.

(Issued as Special Leaflet No. 13).

(8) Broadcast Talk, entitled " AGRICULTURAL SEED SUPPLIES IN 1941 AND 1942," given by MR. D. DELANEY, Inspector, Department of Agriculture, on 20th January, 1941.

The provision of adequate supplies of seed for our farm crops is of paramount importance in present circumstances. Those seeds may be divided into four main classes, namely :—

(1) Those for cereal crops, wheat, oats and barley.
(2) Grass and clover seeds.
(3) Root seeds, and
(4) Seeds for various green crops such as rape, field cabbage, vetches, etc.

So far as wheat is concerned about half the crop is usually sown with imported seed. This will be forthcoming this season in much reduced quantity and will not include spring varieties. Fortunately home-grown seed of the past season's crop is of first-class quality and many of last season's growers have reserved sufficient seed for their own use, particularly of winter varieties. Seed merchants have also assembled considerable stocks of home-grown seed of winter varieties and growers who have not got their own seed should lose no time in securing supplies.

It has come to the notice of the Minister for Agriculture that there is a shortage of seed wheat in certain districts and he has, therefore, authorised flour millers to sell home-grown wheat for seed purposes. It will not be possible to guarantee that this seed is of any particular variety, but provided germination is satisfactory a slight admixture in the case of winter wheat is not of serious importance compared with a seed shortage.

Once more it should be emphasised that seed of spring varieties will be scarce and that every grower who can do so should, therefore, sow winter wheat. So far it has not been found possible this season to import seed oats and there is no certainty whatever that any supplies of imported seed will be available. As in the case of wheat, home-grown seed is of excellent quality and farmers who have not reserved their own seed should immediately seek supplies either from neighbouring farmers or through the usual trade channels.

For several years the whole of the barley area in this country has been sown with home-grown seed, mainly the progeny of pedigree strains propagated at the Department's Plant Breeding Station, and it is assumed that as usual a great many farmers have reserved their own supplies. The remainder will have no difficulty in procuring supplies from the maltsters with whom they usually deal or from seed merchants who have assembled seed barley. It is desirable, however, that the cultivation of barley for feeding purposes should in the coming season extend far beyond the usual barley growing districts and farmers in these districts who propose to sow barley are earnestly requested to lose no time in seeking supplies of seed.

Briefly, the position in regard to cereals is that supplies of seed for 1941 are in sight and that, even if no imported seed is forthcoming in 1942, no cause for uneasiness in respect of that season need now arise.

In regard to grass seeds the great bulk of our consumption consists of Perennial and Italian Rye Grass seeds. We produce our full requirements of the former and so nearly our full requirements of the latter as to be almost self-supporting.

Clover seeds and seeds of natural grasses which are normally imported

are available in reasonable quantity for 1941 but 1942 supplies are doubtful. So long as ample supplies of Ryegrasses are available a temporary shortage of clovers and natural grasses can be borne. The natural grass in greatest demand is Cocksfoot and there are few farms in the country on which the quantity of Cocksfoot seed used annually could not be collected next summer by juveniles along the headlands of a few fields.

There is one class of seed, however, about which there is real cause for anxiety. I refer to root seeds, *viz.*, mangel and turnip. While the position regarding supplies of these seeds is fairly satisfactory so far as the present season is concerned, there is grave danger of a serious shortage in 1942.

Our annual imports of these seeds, mainly from Great Britain, are in the case of mangels about 500 tons and in the case of turnips about 350 tons. Because of increased demand for these seeds in Great Britain it has not been found possible to procure out of the available stocks the usual supplies for sowing here during the coming season and it is possible that a similar position may arise a year hence.

The position has been discussed on many occasions with the Wholesale Seed Trade, who in spite of many difficulties have succeeded in securing reasonable stocks of root seeds wherever possible for sowing in the coming season. Farmers may not be able to procure, in all cases, the particular varieties they have been accustomed to grow, but with the exercise of reasonable economy there should be no shortage. It is the practice of farmers in normal times to use very heavy seedings. With stocks of seed in limited supply and prices relatively high, farmers will not be in a position during the present season to indulge in this practice. Indeed the normal rate of seeding could with safety be substantially reduced in many cases by as much as fifty per cent. It is only by adopting this course that the limited stocks of root seeds in the country will be equal to meeting our requirements. Another point of perhaps equal importance to that of a lighter rate of seeding is that no farmer should this season purchase root seeds in excess of his actual requirements. The farmer who does so will deprive—perhaps unknowingly—some other farmer of his due share or perhaps of any share at all.

That is, shortly, the position in respect of the coming season so far as root seeds are concerned. What of supplies of root seeds for sowing in 1942? Farmer listeners will not need to be reminded that root seeds used in 1942 must, at latest, be harvested in 1941. As already mentioned, we cannot depend on supplies of imported seeds being available in 1942—in fact the position may be worse than at present.

It is appropriate, therefore, to ask can farmers here do anything in the meantime to meet the situation envisaged? Farmers can in fact raise root

seeds on their own farms and, so far as mangel and turnip seeds are concerned, can become independent of imported seed in 1942.

Turnip and mangel seeds have already been raised in this country on an experimental scale, but at least in sufficient quantity to demonstrate that the problem presents no outstanding difficulty. The production of our full requirements of root seeds would not entail more than 700 acres in the case of turnips and 600 acres in the case of mangels devoted to this purpose. Presumably it is because imported seed has usually been so cheap that the raising of our own root seed requirements has not hitherto been undertaken as a commercial enterprise.

Turnips and mangels are biennial plants—in other words they do not normally produce seed in the year in which they are sown. Hence it is that crops intended for seed are usually sown in July or August of one year to produce seed in August or September of the following year. We could not, therefore, at this date in 1941 proceed in the usual way to produce seed for sowing in the 1942 season.

We can, however, save a year by starting now with what are commonly called "Mother" roots—in other words with turnips and mangels from the 1940 crop. If these roots are planted out from the end of February to the middle of April they will sprout in the normal course and produce seed in the autumn. This seed will be available for sowing in 1942. The procedure is in fact similar to that adopted by many market gardeners and farmers who save the seed of cabbages and other brassicas by transplanting the "stumps" or roots of the old plants in a favourable position in early spring. In experimental work on the production of mangel and turnip seed in this country each plant derived from a "Mother" root gave 3 to 4 oz. of seed in the case of mangels and 2 to 3 oz. of seed in the case of turnips. In other words enough seed should be produced from 50 roots of mangels or turnips to provide a liberal seeding for one statute acre of either of these crops.

There is no need to plant out the roots until the end of February to mid-April, but as turnips and swedes are being rapidly used up at present each farmer should take steps to reserve the necessary number of roots and should similarly reserve the necessary number of mangels. The roots selected should be sound, shapely and not very large. Roots 1 to 2 lb. each are the ideal size.

The ground to which "Mother" roots are transferred will need to be cultivated and manured as for an ordinary crop of turnips or mangels. In order to avoid danger of crossing of different varieties only one variety of turnips or of mangels should be planted in the same field.

It should be borne in mind that turnips and swedes will hybridise and also

that both will hybridise with all plants of the cabbage family. Mangels and beet also hybridise.

No particular technique is required in the planting of the "Mother" roots except to place them firmly in the soil in drills or trenches two feet apart and two feet between individual roots and covering lightly with soil. Previous to planting the roots should be crowned, especially the mangels, so as to encourage the development of side shoots and the growth of bushy plants, which produce more seed than those with single upright shoots.

Harvesting.—Time will not permit of dealing in this talk with the harvesting of the crop, but detailed information will be contained in a leaflet which the Department proposes to issue in the near future.* It will suffice to repeat at this stage that most farmers have had some experience in the saving or harvesting of cabbage seed and should, therefore, have little difficulty in saving small quantities of mangel and turnip seed during the coming season.

Seed of rape and vetches will not be available in large quantity this season. Farmers who sowed rape and vetches last autumn should endeavour to reserve a portion of the crops for seed the saving of which should present no appreciable difficulty.

Supplies of cabbage seeds are available but orders should be placed as soon as possible. The growing of Marrow Stem Kale has become very popular in recent years and it is regretted that the quantity of this seed likely to be available is also limited. Just as in the case of mangels and turnips, seed of all species of the cabbage family for sowing next autumn and in the spring of 1942 can be saved by planting out a few dozen roots or "stumps" during the next month or so.

In conclusion, I might summarise as follows :—

1. Sow mangel and turnip seeds at a lighter rate this year than formerly, but do not cut down the area under these crops.
2. Do not order more seed than is necessary to meet individual requirements.
3. Select as soon as possible at least 40 or 50 mangel roots for each acre of mangels to be grown in 1942 and plant them out this spring so as to produce seed next harvest.
4. Do the same in the case of turnips, cabbages, kale, etc.
5. Reserve a portion of growing crops of rape and vetches for the production of seed during next summer.

* **Special Leaflet No. 15—" The Production of Root and Vegetable Seeds."**

(Issued as Special Leaflet No. 14).

VIRUS DISEASES OF TOMATO

By

PHYLLIS E. M. CLINCH, M.Sc., Ph.D.,
Department of Plant Pathology,
University College, Dublin.

INTRODUCTION

The last six years have seen the development of tomato-growing as an industry in Eire, the fruit having previously been cultivated only on a small scale for private consumption or local trade. Besides the erection of many commercial glasshouses for tomato culture there has also been an enormous increase in the number of private garden glasshouses during recent years; this increased cultivation has inevitably stimulated interest in the diseases which attack the tomato amongst which virus diseases are of special importance. Ten years ago very little was known regarding the identity of tomato viruses but the results of various workers on both sides of the Atlantic culminating in those of Ainsworth, Berkeley and Caldwell (4) did much to clarify the situation.

It is the purpose of this paper to describe the principal virus diseases of tomato, to indicate the relationships of the underlying viruses and to record some observations on the diseases occurring in this country. Information on the latter point has of necessity been derived mainly from the examination of diseased specimens submitted through the Department of Agriculture to this laboratory; however, as these specimens emanate from growers all over the country they may be assumed to furnish a fair index of the prevailing maladies. In addition, continual observations have been made during the past six years on outbreaks of virus diseases in certain commercial glasshouses in the vicinity of Dublin. The writer is indebted to Dr. G. C. Ainsworth and Dr. W. F. Bewley of the Cheshunt Research Station for samples of standard virus material which enabled comparative tests to be made.

GENERAL CHARACTERS OF PLANT VIRUS DISEASES

The symptoms of these maladies vary considerably, but one property which they all have in common is their infectious nature. The transmission of the smallest quantity of sap from a virus-infected plant to a susceptible healthy one, whether this be effected by insects feeding on the plant juices

Fig. 1—Tomato plant infected with Single-Virus Streak showing mosaic symptoms. (Common Tomato Mosaic produces a similar effect.)

or by the touching of the leaves of adjacent plants, is liable to cause infection. In the majority of virus diseases the infective agent is systemic, *i.e.*, it is present throughout all parts of the plant with the usual (but not invariable) exception of the seed so that all vegetatively-propagated plants which are infected with a virus disease will reproduce that disease year after year. Generally speaking, plants do not recover from virus disease although the symptoms may become attenuated in the course of time or because of environmental conditions. Certain viruses attack only the members of one plant Family but others infect species from many different Families ; furthermore, the symptoms of a given virus may vary considerably according to the species attacked and in certain cases virus-infected plants may fail to show any symptoms and are said to be " carriers."

The exact nature of the viruses themselves is still unknown. They have many of the properties of living organisms but filtration studies have shown them to be infinitely smaller than bacteria and although they multiply freely within the living plant tissues, no plant virus has yet been found to reproduce itself outside the plant. The present trend of research is to show that plant viruses are chemical substances of protein nature endowed with special properties and that they are not living in the ordinary sense of the word ; but a definite decision as to whether they are animate or inanimate has not yet been reached.

Certain viruses are found to be very closely related in their physical and chemical properties, differing only in the symptoms which they produce on certain host plants, and the term " strain " is used to denote such a relationship. A plant infected with one strain of a virus cannot be reinfected with another strain of the same virus although fully susceptible to infection with a second virus of different type.

VIRUS DISEASES OF TOMATO

The following is a list of the principal virus diseases of the tomato, the technical names of the causal viruses according to Smith's system of classification (29) being shown in brackets in each case.

I. Common Tomato Mosaic (*Nicotiana Virus* I).
II. Single-Virus Streak (*Lycopersicum Virus* I).
III. Tomato Aucuba Mosaic (*Nicotiana Virus* I C).
IV. Enation Mosaic (*Nicotiana Virus* I A).
V. Double-Virus Streak (*Solanum Virus* I + *Nicotiana Virus* or strains thereof).
VI. Spotted Wilt. (*Lycopersicum Virus* 3).

The viruses responsible for the first four of these diseases are very closely related to one another and have similar fundamental properties although differing in the symptoms which they produce on the tomato. *Nicotiana Virus* I, then, may be regarded as the type virus and *Lycopersicum Virus* I, *Nicotiana Virus* I C and *Nicotiana Virus* I A as strains thereof.

1. COMMON TOMATO MOSAIC (*Nicotiana Virus* I)

Characters of the Virus.—The virus causing this disease is also responsible for the classical mosaic disease of tobacco and besides attacking practically all members of the *Solanaceae* it is capable of infecting species of certain other Families. It is one of the most resistant plant viruses known, remaining viable for over a month in crude, expressed sap and for more than a year in sterile, filtered sap at room temperature. In dried leaves, the virus persists almost indefinitely and infection has often been secured after 5 years and, in one instance, after 24 years. Expressed juice is still infectious after being diluted 1 in 100,000 with water. Heating the sap for ten minutes at 90°C. destroys the infective principle, but the virus withstands exposure to glycerine, alcohol, ether, chloroform, and various antiseptics. Formaldehyde and certain other chemicals are toxic to the virus in extracted sap but there is no treatment which will destroy the virus in the plant without at the same time killing the plant itself.

The properties of the viruses causing Single-Virus Streak, Aucuba Mosaic and Enation Mosaic, which, as already mentioned, are strains of *Nicotiana Virus* I, are similar to those set out above.

Symptoms in Tomato—In actively-growing plants the symptoms first become visible about 9 days after infection takes place. The young leaves at the top of the plant present a mottled appearance, certain areas being light green in colour while others are dark green and often raised and blister-like ; in a short time all the other leaves develop a similar mottle and some stunting in the growth of the plant is noticeable. The leaves formed after infection are narrower and more pointed than normal and show deeper marginal indentations. Under conditions of low light intensity, as in winter, stunting and leaf distortion are more conspicuous symptoms than mosaic mottling, the leaflets sometimes being reduced to mere thread-like structures. The mosaic symptoms are usually most pronounced in young, newly-infected plants and tend to fade as the leaves enlarge. The fruit appears normal but it has been calculated that the yield may be reduced by as much as 10 per cent. (19).

The reactions of *Nicotiana Virus* I in certain differential hosts, *viz.*, tobacco (*vars.* White Burley and Yellow Orinoco), *Nicotiana glutinosa* and *Datura Stramonium* are shown in Table I. Systemic mottling follows infection

Fig. 2—Tomato plant infected with Single-Virus Streak showing necrotic streaks on stem and lesions on leaves.

TABLE I.

Symptoms of Tomato Viruses in other Solanaceous Host Plants.

VIRUS	TOBACCO (*var.* Yellow Orinoco)	TOBACCO (*var.* White Burley)	DATURA STRAMONIUM	NICOTIANA GLUTINOSA
Nicotiana Virus I .. .. (Common Tomato Mos.)	Systemic mottling	Systemic mottling	Local necrotic lesions. No systemic infection.	Local necrotic lesions. No systemic infection.
Lycopersicum Virus I .. (Single-Virus Streak)	Local necrotic lesions (Sometimes systemic necrosis)	do.	do.	do.
Nicotiana Virus IC .. .. (Tomato Aucuba Mos.)	Local necrotic lesions	Systemic mottling (bright yellow)	do.	do.
Nicotiana Virus IA .. (Enation Mos.)	Local necrotic lesions	Systemic mottling	do.	do.
Solanum Virus I + *Nicotiana Virus* I type (Double-Virus Streak) ..	Local necrotic lesions; systemic mosaic characteristic of *Solanum Virus* I	Severe systemic mottling and mosaic	Local necrotic lesions; systemic mosaic characteristic of *Solanum Virus* I.	Local necrotic lesions; systemic mosaic characteristic of *Solanum Virus* I.
Lycopersicum Virus 3 .. .. (Spotted Wilt)	Local zoned necrotic lesions and systemic necrosis.	Local zoned necrotic lesions and systemic necrosis.	Local concentric ring lesions; systemic mottling, leaf distortion and stunting.	Local zoned necrotic lesions and systemic necrosis.

in both varieties of tobacco. In the other hosts necrotic lesions are produced at the site of inoculation within 48 hours but the virus does not become systemic.

Mode of Transmission.—Tomato mosaic is one of the most infectious virus diseases known, but there is no evidence that insect vectors are responsible for its spread under natural conditions. The virus, however, can easily be conveyed by mechanical contact between diseased and healthy plants and is most effectively spread in tomato houses through the contamination of the hands, implements or clothes of workmen with infective sap. Owing to its resistant nature even a trace of the virus on hands or instruments may be the cause of infecting a considerable number of healthy plants. Chamberlain (14) observed that the removal of lateral shoots on a crop of healthy tomato plants by men who had previously handled mosaic plants resulted in 83 per cent. infection after three weeks. Similar observations have been made by other investigators.

Occurrence in Eire.—Although *Nicotiana Virus* I is recorded as the most common virus affecting tomatoes in England, the writer has not so far isolated it from infected specimens sent to this laboratory. It cannot be assumed, however, that the virus does not occur in this country: apart from the fact that a systematic survey has not been made, it is recognised that many tomato growers are not alarmed by the appearance of mosaic (some even regarding it as a necessary evil) and unless more serious effects are manifested they may not seek expert advice on this disease.

II. SINGLE-VIRUS STREAK (*Lycopersicum Virus* I)

Symptoms in Tomato.—As a general rule the symptoms consist of a mosaic mottling identical with that caused by Common Tomato Mosaic (Fig. 1) and it is only by the use of differential hosts that the identity of the virus can then be established. Under certain conditions, however, which will be discussed later, the virus produces a striking necrotic effect; longitudinal brown or blackish stripes appear on the stems and petioles and irregularly-shaped necrotic lesions occur on the leaves which frequently wither in consequence and fall off (Fig. 2). The necrotic symptoms do not persist indefinitely the plants invariably growing out of them and showing mosaic symptoms only in the new foliage. The severity of the streak is usually greatest in soft-growing or tender, weakly plants. The fruit of mosaic plants appears normal: where streaking occurs, however, the fruits on necrotic peduncles are frequently affected, displaying irregularly-shaped, shining, yellow or brownish sunken lesions, while young berries may fail to develop or flowers fail to set. It follows, therefore, that the yield of marketable fruits is liable to be seriously reduced by the onset of streak, apart from the reduction in yield due to the effects of mosaic on the plant as a whole.

Fig. 3—Tomato seedling naturally infected with Single-Virus Streak (left) and healthy seedling of same age. Note distortion of leaflets and slight mottle caused by disease.

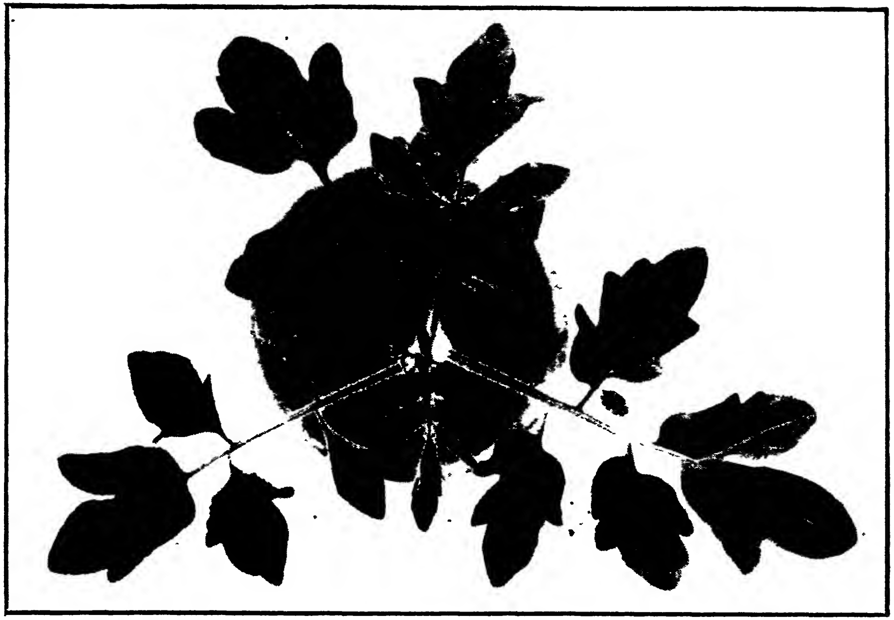


Fig. 4—Tomato seedling naturally infected with Single-Virus Streak showing rolling of leaflets. (This is not a consistent symptom.)

Table I shows that *Lycopersicum Virus* I also differs from *Nicotiana Virus* I in producing a necrotic reaction in tobacco (*var.* Yellow Orinoco). Ainsworth (1) and others record a similar effect on the White Burley variety but in the writer's experiments White Burley has always reacted with a mosaic mottling identical with that of the type virus. The seed used was purchased from Messrs. Vilmorin-Andrieux & Cie., Paris, and no variation has been observed in the plants grown from the several lots of seed obtained. Berkeley (7) noticed that the reactions of *Lycopersicum Virus* I varied with the variety of tobacco inoculated but apparently they may also vary with the strain of seed employed.

In *Datura Stramonium* and *Nicotiana glutinosa* the symptoms of *Lycopersicum Virus* I are identical with those of *Nicotiana Virus* I.

Mode of Transmission.—Similar to that of the type virus, *Nicotiana Virus* I.

Occurrence in Eire.—*Lycopersicum Virus* I is easily the most common virus affecting tomatoes in this country, manifesting itself mainly in the mosaic form. Plants infected with this virus have been obtained from many different parts of the country and outbreaks have been observed year after year in commercial glasshouses in Co. Dublin. In the latter the development of the disease has always followed the same course. The symptoms first appear in a small percentage of the young seedlings in the propagating house. Streak has never been observed at this stage nor, indeed, is mosaic always pronounced. The infected seedlings, however, have a spindling appearance, the leaflets are narrow and the lobes pointed instead of rounded while the veins stand out prominently (Fig. 3). Rolling of the young leaflets along the midribs is also a symptom but not a consistent one (Fig. 4). Although obviously diseased seedlings are usually discarded, a certain number of infected plants evidently find their way into permanent quarters in the glasshouse and are only noticeable when the plants are established and from these the infection is spread throughout the entire crop, particularly by the process of disbudding. In this manner, crops of some thousands of tomato plants set out in March (the majority being then virus-free) have been observed to become 100 per cent. infected by the month of June.

The relative amounts of mosaic and streak occurring in these crops in the different years have varied. Under conditions favouring the development of streak a considerable difference in varietal susceptibility has been observed at the Albert Agricultural College, Dublin, reference to which has been made by Sherrard and Usher (22). Of nine varieties grown together in the same glasshouse in one year, 50 per cent. of the plants of *Balch's Express* and 15 per cent. of *E.S.2* showed streak symptoms and in the former case these were extremely severe and the fruit was badly marked. In the remaining seven varieties the number of streak plants varied from 2 per cent. to 8 per cent. The effects of mosaic, too, (*i.e.*, mottling and stunting) are much greater

on some varieties than on others, the more delicate and less vigorous types appearing to suffer most.

III. TOMATO AUCUBA MOSAIC (*Nicotiana Virus* I C)

This disease was originally observed in tomatoes in England by Bewley in 1923 and was later described in detail by J. H. Smith (23). In America the virus was found occurring naturally in tobacco plants (17).

Symptoms in Tomato.—These are consistent and characteristic taking the form of a brilliant mottling which appears first in the young leaves 8-10 days after infection and gradually extends over the whole plant. Well-delineated bright yellow and white patches are interspersed with areas of light and dark green tissue, producing a conspicuous mosaic pattern which persists throughout the life of the plant (Fig. 6). The leaflets do not attain their normal dimensions so that affected plants have a spindling appearance and the general growth is stunted. There is no necrosis but the writer has observed whitish streaks on the main stem in the primary phase of infection with this virus. Symptoms frequently appear on the fruit in the form of yellowish blotches or rings which as a rule are only skin deep but may be very disfiguring.

Table I shows that the symptoms produced by this virus in other solanaceous hosts are similar to those of *Lycopersicum Virus* I, the only difference being that the mosaic pattern in White Burley tobacco is much more brilliant.

Mode of Transmission.—Similar to that of the type virus, *Nicotiana Virus* I.

Occurrence in Eire.—The disease is much less common than Single-Virus Streak and outbreaks have only been observed at two centres.

IV. ENATION MOSAIC (*Nicotiana Virus* I A)

This disease was first observed on tomatoes in England in 1935 by Ainsworth (3) and Smith (25). The latter also noticed that the same virus was fairly common in tobacco plants in the South-west of France in 1934.

Symptoms in Tomato.—The outstanding character of this disease is the extreme malformation of the affected plant, indeed the plant may be so distorted, according to Smith (25), as to be almost unrecognisable as a tomato. The malformations of the leaves are of several distinct types; the most usual of these is the complete suppression of the leaf blade or lamina so that the leaves consist simply of long thin threads which may be curled and

Fig. 5—Leaf of tomato plant infected with Enation Mosaic showing type of malformation.

twisted (Fig. 5); or there may occur large numbers of very small leaflets placed close together and ending in a corkscrew tendril. Another curious effect is the production on the under surfaces of the leaves of outgrowths (enations) or small additional leaves (25). Ainsworth (3) regards the production of enations as diagnostic of the disease, hence its popular name. He points out that while in the case of Common Tomato Mosaic the tendency to leaf distortion is confined to the winter months, in Enation Mosaic severe malformation of the leaves is the characteristic summer symptom, the degree of distortion in winter being comparatively slight. According to Smith (29) the fruit may be normal in appearance, though poor in quality. He has, however, observed cases in which the fruits are conical and strongly corrugated.

Table II shows that the symptoms of Enation Mosaic in other solanaceous hosts are identical with those of Single-Virus Streak.

Mode of Transmission.—Similar to that of the type virus, *Nicotiana Virus* I.

Occurrence in Eire.—Only one example of this disease in tomatoes has so far been observed here and was brought to the writer's attention by Mr. J. B. Loughnane in 1940. It appeared in a single seedling, one of a small batch planted out-of-doors in a private garden isolated from other tomato plants. The seed was obtained from a grower whose plants had been infected with Single-Virus Streak the previous year. The disease spread to an adjoining plant and its virus nature was further confirmed by inoculation tests.

V. DOUBLE-VIRUS STREAK (*Solanum Virus* I + *Nicotiana Virus* I or strains thereof.)

This disease is due to combined infection with a potato virus (*Solanum Virus* I) and any one of the tomato viruses already described (usually *Nicotiana Virus* I or *Lycopersicum Virus* I.) It has been studied chiefly in the U.S.A. and Canada where it has been the cause of enormous losses to growers.

Characters of Solanum Virus I.—This virus, more popularly known as Potato Virus X, is chiefly confined to potatoes and infection of the latter is so widespread that only special stocks can be guaranteed free from it. In its most common form its effects on potato are confined to a mild mottling of the foliage but other strains exist which cause severe mosaic symptoms. Like the tomato viruses already described, *Solanum Virus* I is transmissible from diseased to healthy plants through the sap and can, therefore, be spread on the hands or implements of workmen as well as by contact between leaves of diseased and healthy plants. No insect vector is known. The virus is less resistant than those of the *Nicotiana Virus* I type; it is destroyed by heating at 70°C. for 10 minutes and loses its in-

fectivity in sterile sap after a few months at room temperature. The virus may remain active in dried leaves for 8-9 months.

Symptoms of Double-Virus Streak in Tomato.—Simultaneous infection with the potato virus and any one of the tomato viruses already described invariably results in the production of streak symptoms somewhat similar to those associated with Single-Virus Streak. Although the streak in this case occurs independently of environmental factors it is intensified by conditions favouring soft growth. Following inoculation of young plants there is an obvious check in growth after 7-9 days, the top leaves become pallid and develop numerous brown or blackish lesions, while dark, longitudinal, slightly sunken streaks appear on the main stem, petioles and peduncles. If the strain of potato virus X is a virulent one, the necrosis rapidly involves the whole top of the plant which subsequently dies. Otherwise, the growing point survives but the necrotic leaves frequently dry out and wither. The leaves formed during subsequent growth are severely mottled and puckered, considerably reduced in size, and also show necrotic lesions. The plant as a whole is severely stunted and of spindly habit. Infection of older plants bearing 3-4 trusses of green fruit is followed by similar symptoms in the young growth but the leaves fully formed at the time of infection remain comparatively normal although streaking of the main stem may extend almost to the base of the plant. It was noticed that the fruits on such plants usually showed symptoms even before the young foliage, a fact also observed by Berkeley (6). These take the form of irregular brown spots or patches all over the fruit, slightly raised above the surrounding surface at first but becoming sunken later. Although mainly superficial, the lesions are sufficiently disfiguring to render the fruit unsaleable.

In *Datura Stramonium* and *Nicotiana glutinosa* (see Table I) Double-Virus Streak is easily distinguishable from other tomato diseases for in both cases the potato virus induces a characteristic systemic mosaic, additional to the necrotic local lesions characteristic of the second component.

Mode of Transmission.—Both types of virus may be spread in the same way *viz.*, on contaminated hands or instruments or as a result of contact between the leaves of healthy and diseased plants. Thus, the potato virus could be introduced into the tomato house by workmen handling the tomato plants after having previously worked with potatoes, or volunteer potato plants amongst the tomato plants could infect the latter by direct contact.

Occurrence in Eire.—Occasional specimens of this disease have been sent from different parts of the country to this laboratory since 1933, the causal viruses in each case being *Solanum Virus* I and *Lycopersicum Virus* I. In 1937, a severe outbreak occurred in a cold greenhouse in Co. Dublin, the property of a grower who personally cultivated all his own vegetables, including potatoes. Streak symptoms appeared in July when the plants

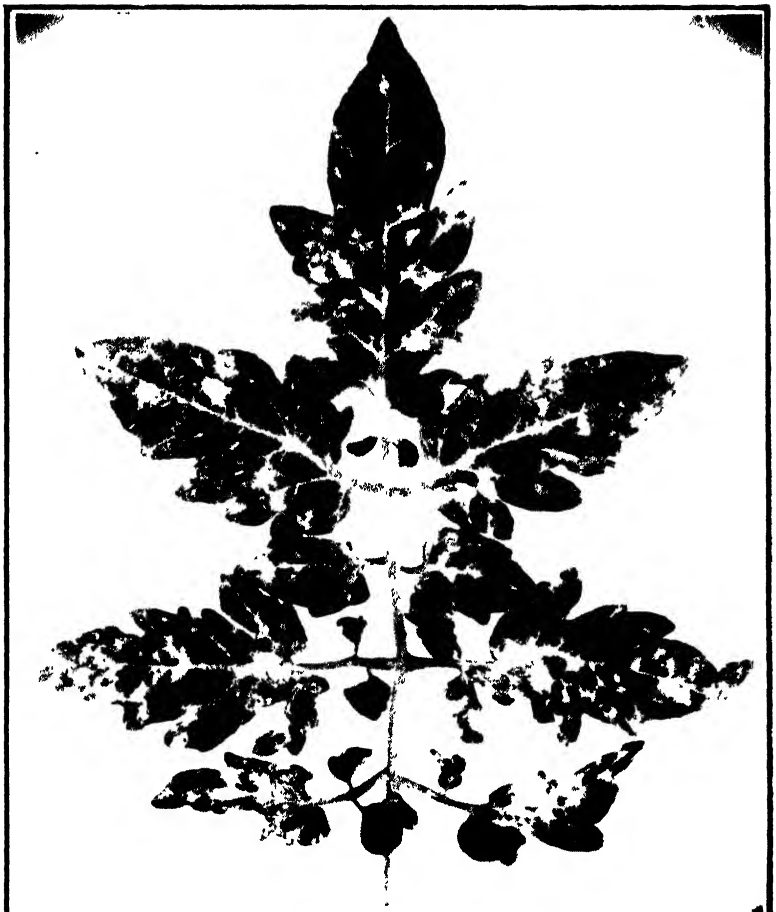


Fig. 6—Leaf of tomato plant infected with Tomato Aucuba Mosaic. showing brilliant yellow mosaic.

already carried 4-5 trusses of green fruit and these became so badly disfigured by the brown markings that they were ruined for market purposes. Investigation showed that mosaic due to *Lycopersicum Virus* I had been widespread in the crop from the early stages, and there was little doubt that the grower had subsequently introduced the potato virus by handling the tomato plants after having worked with potatoes outside.

VI. SPOTTED WILT (*Lycopersicum Virus* 3)

This serious disease was first detected by Brittlebank (12) in Australia in 1919 and recorded by Smith in England in 1932. It has been widely studied by Samuel *et al.* (21) in Australia where it causes enormous losses.

Characters of the Virus.—The Spotted Wilt virus is quite distinct from the tomato viruses already described. It is readily inactivated in expressed sap, which completely loses its infectivity after a couple of hours at room temperature; it is also destroyed by drying and by heating for 10 mins. at 42°C. (5).

Mode of Transmission.—The chief and most effective method of spread is by means of thrips (*Thrips tabaci* L.), minute insects which are exceedingly common in glasshouses as well as out-of-doors and are omnivorous feeders. The virus is also transmissible through the sap and may, therefore, be passed from infected to healthy plants on pruning knives or on the hands of workers. Owing to the extreme instability of the virus, however, spread by this means is comparatively slight and infection does not occur readily unless the plants are young and growing actively and the source recently infected.

Symptoms in Tomato.—About ten days after infection of actively-growing plants, the young leaves become turgid and curl slightly downwards and inwards and the veins stand out prominently. This is immediately followed by a sudden glazing and bronzing of these leaves, usually in irregular spots or circles close to the veins but sometimes over the entire leaf surfaces. At the same time, growth of the plant is completely arrested. The bronze sheen in the young leaves is the chief diagnostic symptom of the disease and in dull weather may last for some time; under hot, sunny conditions, however, the bronze areas wilt and dry out after a few days giving the leaves a rusty appearance or causing them to shrivel up. Growth is later resumed but is very slow; the new leaves are distorted and show conspicuous light and dark green mottling, the edges of the leaflets curl upwards and the entire plant is dwarfed. In this condition it may exist for months. Streaking of the stems has not been observed unless when the Spotted Wilt was combined with another tomato virus.

The effect on the fruit depends upon the stage of development of the trusses

at the time of infection ; if already well-formed the fruit may escape appreciable injury, otherwise it is poor in quality and frequently displays conspicuous markings in the form of large yellow or brown concentric rings or blotches (21).

The symptoms of Spotted Wilt in tobacco, *Nicotiana glutinosa* and *Datura Stramonium* are shown in Table II. In the latter case, the local lesions take the form of concentric rings which require about eight days to develop whereas the other tomato viruses produce lesions in 2-3 days in this host.

Other Hosts of Spotted Wilt.—One of the most dangerous features of the Spotted Wilt virus is its extremely wide host range attacking as it does plants from 19 different Families. Many of these are commonly raised or grown in glasshouses, often in company with tomatoes. They include Arum Lily, Begonia, Calceolaria, Chrysanthemum, Cineraria, China aster (*Callistephus Chinensis*) Dahlia, Gloxinia, Hippeastrum, Lupin, Nasturtium, Petunia, Primula, Salvia, Verbena, Zinnia and many others. Certain common weeds are also attacked *e.g.*, the great plantain, bindweed (*Polygonum*), deadly nightshade, black nightshade and henbane (26). The symptoms vary greatly in these different hosts and only a few of the more important can be described here but the formation of chlorotic rings on the leaves is a common indication of infection in many of them.

Arum Lily (*Richardia africana*).—Conspicuous yellow streaks, blotches and rings on the leaves and sunken white streaks on leaf and flower stalks. Pale rings on the green flower buds, flowers deformed and plants stunted. Ainsworth (2) has emphasised the particular danger of Arums as they are one of the favourite breeding grounds of thrips.

Chrysanthemum.—According to Smith (26) the symptoms on this host are not very characteristic. " Affected plants are rather stunted and the young leaves are twisted and pale. There may be some mottling of dark green near the veins with dark spots on the leaves and stems." The Chrysanthemum, like the Arum Lily, is a most important host as it is frequently present in, or near, glasshouses where tomato seedlings are raised and being a perennial, carries over the disease from year to year. It is unfortunate therefore, that the symptoms in this host are sufficiently vague to enable the virus to escape detection.

Dahlia.—This host is stated to be a frequent source of infection in England and symptoms consist of concentric rings or patterns of wavy lines which are most pronounced in young plants (26). The Dahlia frequently shows a mosaic mottling due to infection with viruses other than that of Spotted Wilt.

Control.—Infected tomato plants should be removed immediately and

burned and a careful watch kept for any new infections in the crop. Following the handling of a diseased plant the hands should be washed with soap and water to remove any traces of infective juice. Regular fumigations with Nicotine should be carried out in order to keep down thrips and possible alternate hosts like Chrysanthemums should be removed as far as possible from the vicinity of the tomato house. The disease is readily controlled except in mixed houses where sources of infection amongst ornamentals are not always easy to detect.

Occurrence in Eire.—Specimens of this disease are received almost every year, the first having been tested by the writer in 1933. In each case it was found that Chrysanthemums, Arum Lilies or Dahlias (sometimes all three) had been grown either in the same house or not very far away from the tomato plants, the infection in Arum Lilies being very conspicuous. It is thought probable that the virus is introduced to new districts mainly in Chrysanthemum cuttings, considerable numbers of which have been purchased from England during recent years.

OCCURRENCE OF A DISEASE DUE TO AN APPARENTLY NEW STRAIN OF *NICOTIANA VIRUS* I.

At the beginning of June, 1939, attention was drawn to a widespread disease of tomatoes in a large commercial glasshouse in Co. Dublin. The middle leaves of the affected plants were partly or wholly patterned with bright yellow and dry brown areas, resulting in a " scorched " or " rusty " appearance, while the tops of the plants showed a conspicuous mosaic. The lower fruit trusses were badly marked by irregularly-shaped, colourless or light brown areas, many of which were sunken. These areas were most extensive at the stalk end but occurred on all parts of the fruit; they were, however, more or less confined to the first-formed fruits, later trusses being mainly sound. The crop generally was well cultivated, weather conditions prior to the outbreak had been exceedingly warm and dry and the lower leaves had been removed from the plants up to a height of 2½ feet.

Inoculations from a typically affected plant gave the following results :—

Tomato.—The inoculated leaves developed yellow markings and grey, water-soaked lesions which soon dried out. In the top leaves, vein-clearing was usually followed by severe veinal chlorosis but the characteristic symptom was the development of irregularly-shaped, sharply-defined small blotches varying in colour from pale green to clear yellow and giving the leaves a speckled appearance (Fig. 7). Under conditions favouring soft growth, wilted areas developed around the spots which on drying out caused a typical " scorching " effect and sometimes eventual withering. The speckling and " scorching " were confined to the lower and middle leaves

of the plants, the later growth showing mosaic only. Some fruit marking was observed which was mild compared with that in the original plants and took the form of yellow blotches somewhat similar to those caused by Aucuba Mosaic. It was concluded, therefore, that the severe fruit injury observed in the commercial glasshouse was partly due to virus and partly to the direct effect of the sun's rays producing the condition known as " hard back " (11) which results in a browning at the stalk end of the fruit.

Tobacco (*var.* White Burley).—Symptoms consisted of grey, water-soaked lesions on the inoculated leaves followed by systemic mottling (similar to that of *Nicotiana Virus* I) accompanied by yellow blotches on the leaves.

Tobacco (*var.* Yellow Orinoco.) *Nicotiana glutinosa.* *Datura Stramonium.*	Local necrotic lesions : no systemic infection.

The reaction of the virus in these host plants indicated a close relationship with *Lycopersicum Virus* I and immunity tests proved it to be another strain of *Nicotiana Virus* I. The name " Speckling Mosaic " would be applicable to the disease.

SOURCES OF INFECTION

In the case of Spotted Wilt, the obvious sources of infection for the tomato crop are infected perennial plants such as Chrysanthemum, Arum Lily, etc., which are frequently grown in the vicinity of the tomato plants and from which infection can be spread freely by the ubiquitous thrips. Infection from soil or any other non-living medium is ruled out on account of the rapidity with which the virus is inactivated *in vitro* and several investigators have proved that Spotted Wilt is not carried over in tomato seed.

There is much less agreement as to the manner in which the other viruses (*Nicotiana Virus* I and its various strains) originate in glasshouse crops of tomatoes especially as they are not insect-transmissible. Since the spread of these viruses is practically impossible to control once infection of the crop sets in, it is very necessary to consider possible ways in which the infection may originate. These are as follows :—

(1) Seed Infection.
(2) Infection from manufactured tobacco.
(3) Soil infection.
(4) Infection from weeds.

Seed Infection.—The question as to whether tomato viruses are transmitted through the seed is extremely important since so many crops are infected

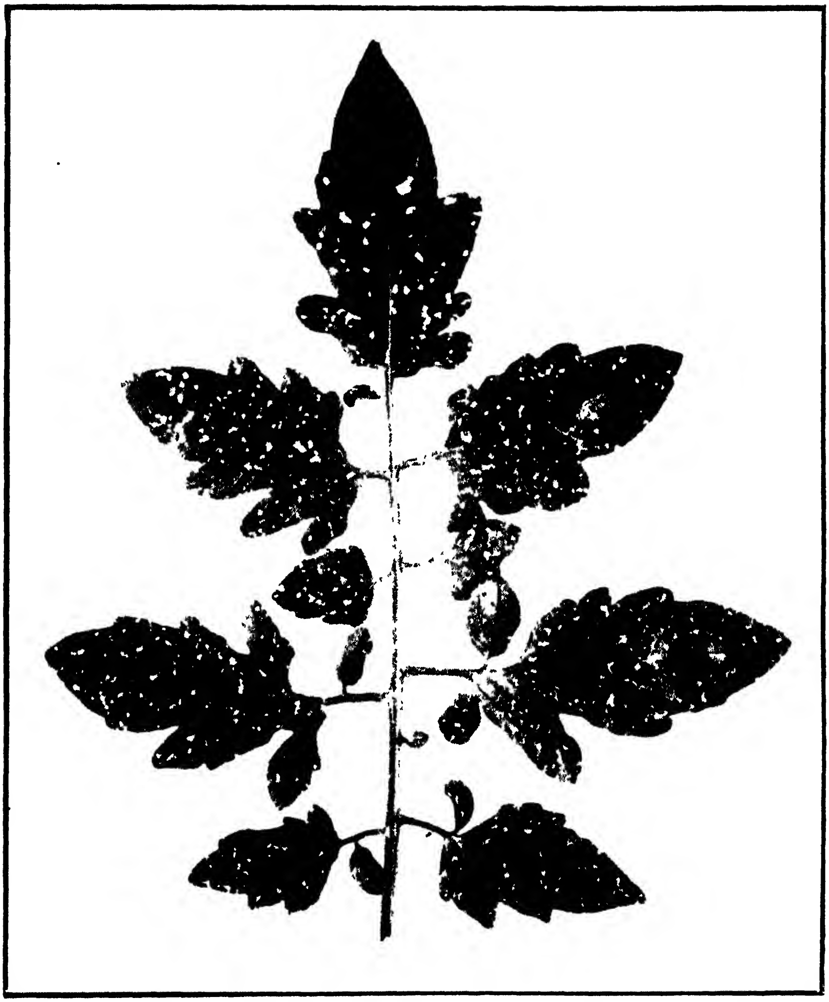


Fig. 7—Lower leaf of tomato plant showing speckling due to an apparently new strain of *Nicotiana Virus* I.

with mosaic and most growers do not hesitate to save seed from mottled plants, provided they are reasonably vigorous. Opinion is divided regarding the question of seed transmission of tomato mosaic as many investigators have failed to obtain infected plants from the seed from diseased fruits. Doolittle and Beacher (15) however, found that freshly extracted seed from diseased fruit yielded 13 out of 257 infected plants although they did not definitely establish the presence of the virus in stored seed. Van Koot (30) records about 1 per cent. infection from freshly-extracted seed. Berkeley and Madden also adduced evidence of seed transmission in a few cases and found that *clean crops were obtained by the use of clean seed* (8). Bewley and Corbett (10) obtained 6.04 per cent. of infected seedlings from a batch of 493 tomato plants grown from seeds from infected fruit.

In an experiment carried out by the writer some further evidence on the question was obtained. Seed was saved from a plant infected with Double-Virus Streak (*Solanum Virus* I and *Lycopersicum* I) the flesh of the fruit having been tested and found to contain both viruses. Part of the seed was well washed with 1 per cent. Sodium Carbonate and water so that the membraneous capsules were completely removed and the remaining seed was washed with water in such a way as to remove adhering flesh but leave the enveloping capsules intact. The seeds were dried and sown in the following spring, the plants being raised in 4-inch pots filled with fresh compost and grown in isolation. Two of the resulting 185 plants were infected with *Lycopersicum Virus* I and both infections occurred in the plants grown from the crudely-washed seed, although in view of the small numbers involved, no special significance can be attached to this latter fact. Furthermore, the fact that several outbreaks of Single-Virus Streak in commercial crops have been observed to originate in the seedlings is at least an indication, though not a proof, that infection may come in the seed.

The evidence generally seems to indicate that while the vast majority of seedlings grown from seed of infected plants may be healthy, a small fraction is liable to be diseased. As the presence of one or two infected plants may easily lead to the eventual contamination of an entire crop, the advisability of using seed from virus-free plants, if possible, cannot be over-emphasised.

Soil Infection.—The extent to which a tomato crop may become infected from soil which previously carried a diseased crop has been the subject of several investigations. It is well known that the type virus (*Nicotiana Virus* I) persists in the soil in plant remains for at least as long as the plant tissues remain undecayed, resisting freezing and desiccation (16). Jones and Burnett (19) however, found that less than 1 per cent. of tomato plants showed infection when set in soil which had previously grown diseased plants and in which infected roots and tops had been stored, and similar results were obtained by other workers. The reason for this is attributable to the fact that tomato plants are infected only with difficulty through the roots,

as shown by Johnson (18) and Mulvania (20). Van Koot (30), however, believes that if virus is present in the soil much infection may occur through contact of the young leaf and stem parts with the soil as a result of splashing while watering.

Jones and Burnett also found that no infection occurred when Chrysanthemums were grown for six months between two successive crops of tomatoes. At the Albert Agricultural College, Dublin, a healthy crop of tomatoes was grown in the commercial glasshouse in 1936 in soil which had carried a diseased crop in the previous year and had not been sterilized in the meantime. On the other hand, previous sterilization of the soil with steam or with formaldehyde did not prevent 100 per cent. mosaic in crops from which small numbers of infected seedlings had not been rogued out in time.

In this country six months is the normal period which elapses between successive crops of tomatoes so that the danger of infection from the previous crop should be slight. Nevertheless, the possibility of infection from this source should be borne in mind and all possible precautions taken to remove diseased plant parts at the end of each season.

Infection from Manufactured Tobacco.—The tobacco plant is the common host of *Nicotiana Virus* I and related strains and it is the belief of several investigators that ordinary smoking tobacco is one of the most fruitful sources of infection for the tomato crop. The type virus is unaffected by the curing process and its presence in commercial brands of tobacco, especially cigarettes, is an established fact. Infection is presumed to take place as a result of the contamination of the hands of workmen from cigarettes or pipe tobacco, the virus being subsequently introduced into the tomato plants through slight wounds made in handling the plants. Jones and Burnett (19), amongst others, state that several outbreaks were traced directly to this cause. Smith (27) traced an outbreak of Tomato Aucuba Mosaic in England to the cigarettes smoked by the man in charge of the plants and besides regarding smoking tobacco as a common source of infection, he considers it to be the means of introducing new viruses into the country.

While not attempting to minimise the obvious danger of infection from this source the writer is inclined to regard seed infection as a more plausible explanation of the various outbreaks of Single-Virus Streak observed in Co. Dublin. Apart from the other reasons mentioned there is no evidence that this particular strain of *Nicotiana Virus* I occurs naturally in tobacco, so far as the writer is aware, and there appear to be few varieties of tobacco in which it becomes systemic without having a lethal effect.

Infection from Weeds.—Practically all species of the *Solanaceae* as well as weeds and cultivated plants of certain other Families are susceptible to infection with *Nicotiana Virus* I. In England, Caldwell isolated a virus

indistinguishable from that of Single-Virus Streak from nettles and horse-radish (13). As these viruses are not insect-transmissible, the danger of infection from alternate hosts is not so great as in the case of Spotted Wilt, particularly to plants grown in glasshouses where weeds are normally eradicated. No evidence can be offered by the writer regarding infections of tomato crops from weeds.

CONTROL MEASURES

Since there is no cure for the diseases which have been described and in view of their infectious nature, control measures must be aimed chiefly at preventing infection in the first instance. The special case of Spotted Wilt has already been dealt with and the following recommendations apply to tomato virus diseases in general :—

1. Tomatoes should be isolated as far as possible from other plants during their entire growing period. Weeds should be eradicated from the glasshouse and its immediate vicinity.
2. Only seed saved from virus-free plants should be sown ; fresh compost should be used for seedlings.
3. Following germination, a close watch should be kept on the tomato seedlings and any showing mosaic or other abnormality discarded. Apparently healthy seedlings actually touching an infected one should be set aside until the incubation period (8-10 days) has elapsed, in case infection has taken place by contact.
4. Workmen should not use tobacco when handling the tomato plants particularly in the young stages. Those who smoke can remove possible traces of infection from their hands by washing them well with soap and water.
5. Only plants which appear healthy should be set out in permanent quarters in the glasshouse. As soon as the plants are established and making active growth and *before the operations of disbudding and tying are begun*, they should be examined carefully and any plant showing virus symptoms dug up and burned. (Once disbudding has started it is extremely difficult to prevent spread of disease by rogueing, except in the case of Spotted Wilt).
6. After handling diseased plants* the hands should be well washed with soap and water before touching healthy plants.
7. Assuming that a crop has become infected beyond control, maintenance of a well-balanced and hardy type of growth, such as is achieved by liberal use of Sulphate of Potash and adequate lighting, will minimise the disease symptoms.

*Includes potatoes as well as diseased tomatoes.

8. The insect population of the glasshouse should be kept as low as possible by regular fumigation with nicotine.
9. The soil of the glasshouse should be freed from all plant remains at the end of the season. Sterilization by means of steam or formaldehyde besides controlling fungus diseases will also inactivate viruses and is therefore desirable following removal of an infected crop.

FACTORS GOVERNING THE APPEARANCE OF STREAK SYMPTOMS FOLLOWING INFECTION WITH SINGLE-VIRUS STREAK (*Lycopersicum Virus* I)

The determination of the factors governing the appearance of the streak symptoms following infection of tomato plants with Single-Virus Streak is obviously a matter of importance in view of the widespread occurrence of the virus and the damage which may be occasioned by the necrotic form of the disease. English workers associated the appearance of the streak with the presence of excess Nitrogen in the soil; on the other hand, a serious outbreak was observed in a new commercial glasshouse in Co. Dublin where Potash had been applied at the rate of one ton to the acre up to 30th April, the streak making its appearance early in May. Relatively small quantities of nitrogenous fertilizers had been given previous to the outbreak but the plants were rather crowded and growth was rapid at the time the streak appeared.

Some experiments were accordingly made to determine whether the appearance of streak symptoms could be directly connected with excess or lack of either potash or nitrogenous fertilizers. Uniform batches of young tomato plants were used for each experiment. These were grown in the experimental glasshouses in pots or wooden boxes in a compost consisting of fresh loam with a suitable admixture of leaf-mould and sand. Different lots of plants were subjected to the manurial treatments set out in Table II. and inoculated with *Lycopersicum Virus* I from the stock supplied by Dr. Ainsworth. Inoculations were made by the rubbing method when the plants were 6-8 inches high and in a state of active growth. Inoculum used in each experiment was tested on tobacco (*var.* Yellow Orinoco) and its ability to produce necrosis in that host confirmed. The fertilizers were added at 10-14 day intervals in sufficient quantities to influence the type of growth, colour and texture of foliage, etc., without, at the same time, causing wilting or other injury to the plants: in any given experiment each lot of plants received equal quantities by weight of the required fertilizer or mixture of fertilizers. All plants were retained for a minimum period of six weeks after inoculation.

TABLE II.

Effect of Different Manurial Treatments on the Symptoms produced following Inoculation of Tomato Plants with *Lycopersicum Virus* I.

Experiment No.	Variety	No. of Plants	Details of Fertilisers added	Date of 1st application	No. of plants inoculated	Date of inoculation	No. showing mosaic symptoms	No. showing streak symptoms	Uninoculated Controls
I	Kondine Red	Lot A—20 ,, B—20	Lot A *{1 Sulphate of Ammonia, 2 Superphosphate, 1 Nitrate of Potash} Lot B {1 Nitrate of Ammonia, 2 Nitrate of Potash}	2nd May	Lot A—10 ,, B—10	27th April	Lot A—9 ,, B—9	Lot A—1 ,, B—1	No symptoms
II	Kondine Red	20	Sulphate of Potash 20 plants	2nd May	10	16th April	10	0	No symptoms
III	Kondine Red	20	Sulphate of Potash 10 plants Nitrate of Soda 10 plants	3rd April	20	3rd April	20	0	—
IV	Balch's Express	Lot A—15 ,, B—15	Lot A {*1st application* 1 Sulphate of Ammonia, 2 Nitrate of Potash, 1 Superphosphate; *Subsequent applications* Nitrate of Potash} Lot B Sulphate of Potash	2nd Sept.	Lot A—10 ,, B—10	9th Sept.	Lot A—10 ,, B—10	0	No symptoms
V	Balch's Express	Lot A—10 ,, B—10 ,, C—10 ,, D—10	Lots A & B {1 Sulphate of Ammonia, 2 Nitrate of Potash, 2 Superphosphate} Lots C & D {2 Sulphate of Potash, 1 Superphosphate}	9th Sept.	Lot A—10 ,, B—10 ,, C—10 ,, D—10	18th Sept.	Lot A—10 ,, B—10 ,, C—10 ,, D—10	0	—
VI	Balch's Express	Lot A—12 ,, B—12 ,, C—12	Lot A Sulphate of Potash Lot B Sulphate of Ammonia Lot C {1 Sulphate of Ammonia, 2 Sulphate of Potash, 3 Superphosphate}	10th June	Lot A—12 ,, B—12 ,, C—12	24th June	Lot A—12 ,, B—12 ,, C—12	0	—

* Parts by weight.

Experiment I.

Two different nitrogenous fertilizers, as shown in Table II, were applied to the plants five days after inoculation. The pots were placed close together in a fairly shaded part of the glasshouse and growth was soft and rapid. Two plants (one from each of the treated lots) developed streak lesions on the stems and mosaic in the foliage; the remainder showed strong mosaic symptoms as well as some longitudinal pale areas on the stems which, however, did not become necrotic.

Experiment II.

Soft, rapid growth was induced by placing the young plants close to the hot pipes. Following inoculation the plants developed severe mosaic symptoms but no streak; they then received a liberal application of Sulphate of Potash, after which mosaic symptoms became less intense but no streak developed.

Experiment III.

The comparative effects of Sulphate of Potash and Nitrate of Soda were examined, the fertilizers being applied on the day of inoculation and at intervals of fourteen days afterwards. Mosaic symptoms developed in all plants. Five weeks after inoculation the tops of the plants were cut to force the axillary shoots into growth; the latter showed mosaic only.

Experiment IV.

The variety Balch's Express was used in this and succeeding experiments because of its observed susceptibility to streak. Again the comparative effects of Potash and a nitrogenous manure (see Table II) were examined, but inoculations were not made until seven days after the first application of fertilizers when the effects of the latter were already manifest. Growth of the plants receiving the nitrogenous manure was soft and luxuriant while the Potash plants were comparatively small, "hard" and dark green in colour. Mosaic symptoms developed in all the plants but were much more pronounced in those making soft growth.

Experiment V.

The temperature factor was introduced in this experiment which was otherwise similar to Experiment IV. Two batches of plants, which were duplicates as regards manurial treatments of the component lots, were grown, one in a heated and the other in an unheated glasshouse. As the experiment was carried out in September the considerable difference in temperature between the two houses was reflected in the growth rates of the different batches of plants; those in the cold house grew very slowly, the leaves were small and "hard" and showed only a faint mosaic beginning about eighteen days after inoculation. The reactions in the heated house were similar to those recorded in Experiment IV, the incubation period in this case being ten days. None of the plants showed streak.

Experiment VI.

The possibility that a sudden check to the growth of the plants in the early stages of infection might be a factor predisposing to streak was visualised in this experiment. Three lots (A, B and C) of twelve plants each were liberally treated with a potassic, a nitrogenous and a complete fertilizer respectively as shown in Table II, and when the effects of the treatment began to show all the plants were inoculated. Nine days later, when symptoms were beginning to appear, six plants from each lot were placed out of doors for 48 hours, the weather being cold and dull. No streak appeared but all the plants showed mosaic symptoms. The latter were most pronounced in the plants of lot A (receiving complete fertilizer) the growth of which was softer and more luxuriant than that of the other lots. A repetition of this experiment on a larger scale yielded the same result.

It will be seen that in only one of the foregoing experiments were streak symptoms obtained *viz.*, in Experiment I when the plants were grown closely together in a shaded position and supplied with nitrogenous fertilizers only. Even then, only a fraction of the plants showed necrosis and plants grown under similar conditions in other experiments developed mosaic only. The intensity of the mosaic symptoms was in all cases increased by soft growth but none of the factors examined appeared to be directly responsible for the appearance of streak or furnished a means of producing it at will in pot-grown plants.

Apart from these experiments, however, several commercial crops of tomatoes infected with *Lycopersicum Virus* I have been observed during the past six years and in these streak occurred most frequently where plants were making very rapid growth due to overcrowding, high temperatures or too liberal supplies of Nitrogen.* It was also noticed that streak occurred in the experimental glasshouse following inoculation of tender, weakly seedlings growing under conditions of poor light intensity in the month of February. The "hard" type of growth associated with strong sunlight and ample supplies of Sulphate of Potash usually coincided with a minimum of streak, but Potash of itself does not inhibit the appearance of streak if other factors combine to neutralise its hardening effect. It was noted that very little streak developed in a crop which was severely attacked by the Root Rot fungus (*Colletotrichum atramentarium*) and this was attributed to the stunting and hardening effect of the fungus disease on the plants. The streak symptom, then, can be obviously connected in a general way with soft, tender, growth but the precise cause underlying the appearance of the necrosis is still undetermined.

It was noticeable that of the hundreds of experimental plants inoculated

*Bewley's (9) experiments demonstrated a connection between soft growth and the incidence of "stripe" disease, believed at the time to be due to *Bacillus lathyri*. It is probable that much of the so-called "stripe" was in reality due to Single-Virus Streak.

with *Lycopersicum Virus* I during the past six years, not one of those which developed mosaic reverted to streak at a later date and whenever streak occurred it was as an initial symptom. In the infected commercial crops also it has been observed that streak occurs only during the period when the virus is spreading amongst the plants and a late outbreak of streak in a crop already showing mosaic has never been seen. These observations have led to the belief that streak due to *Lycopersicum Virus* I occurs as a primary symptom or not at all: the supposition, however, could not be definitely proved on account of the inability to produce streak symptoms at will in experimental plants.

EFFECT OF "HARDENING" CONDITIONS ON VIRUS DISEASE SYMPTOMS

The following experiment was carried out primarily to determine whether the application of excessive quantities of Sulphate of Potash to tomato plants was liable to cause fruit injury, but incidentally demonstrated the manner in which symptoms may be modified by environmental conditions.

Ten actively-growing young tomato plants (*var.* Clybran's Victory) were transplanted from 7-inch pots to wooden butter boxes, the compost consisting of fresh loam, peat mould and sand to which the following fertilizers were added :—

Sulphate of Potash	.. .. ..	1½ ozs. per bushel.
Superphosphate	.. .. ..	3 ,, ,,
Hoof and Horn	.. .. ..	3 ,, ,,

On 20th May the plants were transferred to an unheated house during a spell of hot, sunny weather which lasted until the beginning of July. On 28th May, when the first fruit trusses were well set, seven of the plants were inoculated with virus diseases as follows :—Single-Virus Streak (2), Double-Virus Streak (2), "Speckling Mosaic" (see p. 35) (2) and Aucuba Mosaic (1). The boxes were set on raised benches in full sun and besides the fertilizers added to the original compost, each plant subsequently received four applications of the following mixture at the rate of 1 oz. per plant :—

Sulphate of Potash	..	1 part
,, Ammonia	..	1 ,,
Superphosphate	..	8 parts

In addition, four plants (two uninoculated, one Single-Virus Streak and one "Speckling Mosaic") each received 10 ozs. of Sulphate of Potash given in five applications from 25th April to 1st July, inclusive.

The high soil temperature in the boxes promoted extremely vigorous growth but there was no tendency to " softness " in any of the plants on account of the high light intensity and dry atmospheric conditions. In all cases there was a decided reduction if not a repression of the disease symptoms. Even in the plants infected with Double-Virus Streak, the necrotic effects remained superficial and soon dried out. Fruit was excellent and showed practically no symptoms except in the upper trusses when the plants were maturing. It was especially interesting to observe that the excessive amounts of Sulphate of Potash added to four of the plants failed to cause any injury to the fruit, even under environmental conditions which would be expected to aggravate its hardening effects.

SUMMARY

A description is given of the principal virus diseases of tomato, *viz.* Common Tomato Mosaic, Single-Virus Streak, Aucuba Mosaic, Enation Mosaic, Double-Virus Streak and Spotted Wilt. The relationships of the underlying viruses are indicated and their properties (including mode of transmission) are described.

Single-Virus Streak is the most common disease in Eire, manifesting itself principally in the mosaic form. Of the other diseases, Common Tomato Mosaic is the only one not so far encountered but its absence from the country is not necessarily implied.

A disease which causes a speckling or " scorching " of the lower leaves of tomato plants is described : immunity tests showed the causal virus to be another strain of the Common Tomato Mosaic Virus (*Nicotiana Virus* I).

The possible ways in which tomato crops may become infected with virus diseases are outlined and discussed. Outbreaks of Single-Virus Streak are attributed to the use of seed from diseased plants : the presence of a few infected seedlings is sufficient to cause eventual infection of an entire crop. The disease was not contracted from soil which carried an infected crop in the previous year.

Outbreaks of Spotted Wilt have been traced to infected Arum Lilies, Chrysanthemums, Dahlias, etc., growing in the vicinity of the tomato plants, the virus being spread by thrips (*Thrips tabaci* L.).

Control of Spotted Wilt in unmixed glasshouses is accomplished by rogueing out diseased plants and fumigating with Nicotine to destroy the insect vector. Control of Single-Virus Streak by rogueing is extremely difficult once the operations of disbudding, tying, etc., have begun, the virus being

spread freely through contamination of hands and instruments with infective sap.

To avoid infection in the first instance, tomatoes should be isolated as far as possible from other plants, only seed from virus-free plants should be sown and the use of tobacco by those handling the plants avoided. The hands should be washed with soap and water to remove infection after handling diseased plants.

Manurial experiments with pot plants showed that the appearance of the necrotic form of Single-Virus Streak cannot be attributed directly to lack or excess of either nitrogenous or potassic fertilizers and the precise cause of the streak symptom is undetermined. Nevertheless, conditions favouring soft growth also favour the necrosis, besides increasing the intensity of the mosaic symptoms. It is suggested that the necrosis occurs as a primary symptom of Single-Virus Streak or not at all.

Maintenance of a well-balanced or somewhat "hard" type of growth reduces the intensity of mosaic and streak symptoms in infected crops. Applications of abnormally large quantities of Sulphate of Potash did not affect the fruit adversely.

In conclusion I should like to express my indebtedness to Dr. R. McKay for his interest and helpful criticism: to Professor G. O. Sherrard and other members of the Horticultural Department for facilities afforded and assistance generously given; and to Mr. G. H. McLean for taking the photographs.

REFERENCES

(1) Ainsworth, G. C.—Ann. Appl. Biol. 20: 421–8. (1933).
(2) ———— Gard. Chron. 97: p. 81 (1935).
(3) ———— Ann. Appl. Biol. 24: 545–56. (1937).
(4) ———— Berkeley, G. H. and Caldwell, J.—*Ibid.* 21: 566–80. (1934).
(5) Bald. J. G. and Samuel, G.—Austr. Council Sci. and Ind. Res. Bull. No. 54. (1931).
(6) Berkeley, G. H.—Sci. Agric. 7: 210–23. (1926).
(7) ———— Canad. J. Res. C., 14: 419–24. (1936).
(8) ———— and Madden, G. O.—Sci. Agric. 13: 455–7. (1933).
(9) Bewley, W. F.—Diseases of Glasshouse Plants. Benn. London. (1923).
(10) ———— and Corbett, W.—Ann. Appl. Biol. 17: 260–5. (1930).
(11) ———— and White, H. L.—*Ibid.* 13: 323–38. (1926).
(12) Brittlebank, C. C.—J. Dept. Agric. Vict. 17: 231–5. (1919).
(13) Caldwell, J.—J. Min. Agric. 41: 743–9. (1934).
(14) Chamberlain, E. E.—N. Zealand J. Agric. 55: 168–74. (1937). (*Abst.* in R.A.M. 17 2, 1938).

(15) Doolittle, S. P. and Beecher, F. S.—Phytopath. 27 : 800–1. (1937).

(16) Hoggan, I. A. and Johnson, J.—J. Agric. Res. 52 : 271–94. (1936).

(17) Johnson, J.—Wisc. Agric. Exp. Sta. Res. Bull. No. 76. (1927).

(18) ———— J. Agric. Res. 54 : 239–73. (1937).

(19) Jones, L. K. and Burnett, G.—Agric. Exp. Sta. State Coll. Washington Bull. No. 308. (1935).

(20) Mulvania, M.—J. of Bact. 19 : 23–24. (1930).

(21) Samuel, G., Bald, J. G. and Pittman, H. A.—Aust. Council Sci. Ind. Res. Bull. No. 44. (1930).

(22) Sherrard, G. O., and Usher, J.—Saorstát Éireann J. Dept. Agric. 34 : 124–30. (1936).

(23) Smith, J. H.—Ann. Appl. Biol. 15 : 155–67. (1928).

(24) Smith, K. M.—J. Min. Agric. 39 : 1097–1103. (1933).

(25) ———— J. Roy. Hort. Soc. 60 : 448–51. (1935).

(26) ———— Sci. Hort. 4 : 126–40. (1936).

(27) ———— J. Roy. Hort. Soc. 65 : 243–4. (1940).

(28) ———— Recent Advances in the Study of Plant Viruses, London. (1933).

(29) ———— A Textbook of Plant Virus Diseases. London. (1937).

(30) Van Koot, Y.—Meded. Inst. Phytopath. Wageningen No. 33. (1939).

(Received for publication on 25th January, 1941).

THE SUSCEPTIBILITY TO LEAF ROLL OF CERTAIN POTATO VARIETIES AND ITS EFFECT ON THEIR YIELD

By

JAMES B. LOUGHNANE, B.Agr.Sc., M.Sc.,
Department of Plant Pathology,
University College, Dublin.

INTRODUCTION

The potato leaf roll virus (*Corium solani* of Holmes, *potato virus I* of Johnson, *Solanum virus* 14 of Smith) probably occurs wherever potatoes are grown and so far as is known no variety is immune. The symptoms in potato are characterised by rolling of the leaves, which become thickened, stiff and of a leathery texture while affected plants as a general rule are dwarfed and chlorotic and the tubers of certain varieties develop necrosis of the phloem elements in the first year of infection. Leaf roll is the most serious virus disease attacking potatoes because of the great reduction in vigour and yield caused by it in most varieties and because it is capable of being transmitted with ease from plant to plant by certain aphis species. In Ireland the disease is practically absent in the good seed producing areas in the West and North-West and when it appears in these areas it generally does so in stocks newly introduced from outside the country. The scarcity of leaf roll in such areas may be attributed to the fact that the aphis species which act as vectors of the virus occur in negligible numbers in the potato crops (2). In the midlands and south midlands the disease occurs in old stocks of certain varieties, particularly Up-to-Date and crops of this variety have been examined in which upwards of 60 per cent. of the plants were affected with leaf roll. Such heavy infection, however, can be explained by the fact that the " seed " of these crops had not been changed for a number of years and as Up-to-Date is a variety which gives a fair yield even when diseased with leaf roll, the necessity for changing " seed " is not forced upon the grower.

As regards the susceptibility of potato varieties to leaf roll, very little work of an exact nature has been done particularly in the case of varieties of recent introduction. Murphy (8) in a preliminary experiment found that the amount of disease which developed in the different varieties with

Turning now to the susceptibility of the various varieties in the experiments ; from a comparison of the figures for percentage leaf roll in the varieties British Queen, President and Flourball for the 1937 and 1938 experiments a Table has been drawn up (Table VI) showing the percentage leaf roll in all the varieties in the experiments which would occur under the 1938 conditions and the following grouping is suggested :—

Group I. Most susceptible.—Arran Cairn, Up-to-Date, Arran Signet.

Group II. Intermediate.—Arran Pilot, British Queen, Kerr's Pink, Gladstone, Arran Peak, Arran Victory, Dunbar Yeoman, Ulster Monarch, May Queen, President, Great Scot, Arran Crest, Epicure, Redskin, Dunbar Standard.

Group III. Least susceptible.—Flourball, Arran Banner, Majestic.

From the results of the yield test it is apparent that the effect of leaf roll on the yield of a potato variety is in direct proportion to the effect of the disease on the vigour of the plants. It may also be said that as a class, early varieties appear to have their yield seriously reduced when attacked by leaf roll. In the case of maincrop varieties on the other hand, there would seem to be a great variation in the effects of the disease on their vigour and yield, but here also serious reduction in yield follows extreme lowering of vigour. This is well illustrated in the two maincrop varieties President and Up-to-Date. In the former, leaf roll causes severe dwarfing and yellowing of the plants with the result that the yield of tubers from such plants is negligible. In the latter, affected plants as a rule are not appreciably stunted, rolling is confined to the lowest leaves and there is not much reduction in green colour and the yield generally is reduced by less than 50 per cent. Unfortunately the number of leaf roll plants used in some varieties in the yield test was not large but nevertheless it is considered that the results justify the following grouping :—

Group I. Yield reduced by 80 *per cent. or over.*—King Edward, President, May Queen, Arran Crest, Arran Pilot, Arran Signet, Redskin, Dunbar Yeoman.

Group II. Yield reduced by 50–80 *per cent.*—Epicure, Arran Cairn, Dunbar Standard, Ulster Monarch, Arran Banner, Eclipse, Gladstone, Arran Peak, British Queen, Kerr's Pink, Arran Victory.

Group III. Yield reduced by 50 *per cent. or less.*—Up-to-Date, Great Scot, Majestic, Flourball.

SUMMARY

The literature on the subject of varietal susceptibility to potato leaf roll is discussed.

The effects of leaf roll on the vigour of some of the newer varieties are described and the varieties used in the experiment are grouped on this basis.

The layout of the experiment is given.

Aphis counts on the experimental plots in 1937 and 1938 showed the date of initial infestation by *M. persicae* to be May 13th and May 12th respectively while the maximum infestation occurred about mid-June and towards the end of May in the respective years.

Tables are given showing the development of primary leaf roll in each year in the different varieties and it is concluded that the period during which most primary leaf roll appears is connected with the date of maximum infestation by *M. persicae*. Early varieties show less primary leaf roll than do maincrop varieties.

There is a significant difference in the extent of spread of leaf roll to plants in drills at different distances from the sources of the virus.

The varieties in the experiments are divided into three groups on the basis of their susceptibility to infection with the leaf roll virus.

An experiment on the effects of leaf roll on the yield of a number of potato varieties is described.

It is concluded that the reduction in the yield of a variety is in direct proportion to the reduction in vigour of that variety caused by leaf roll.

The varieties used are grouped according to the reduction in yield shown by them as a result of leaf roll infection.

ACKNOWLEDGMENTS

The author desires to extend thanks to Dr. R. McKay, Lecturer in Plant Pathology, University College, Dublin, for much helpful advice during the conduct of the experiments and for criticism and suggestions in the preparation of the manuscript; to Mr. F. P. Hussey, A.R.C.Sc.I., N.D.A., who so kindly carried out a statistical examination of the results and to Mr. G. H. McLean for taking the photographs.

References

(1) Gardner, M. W., and Kendrick, J. B. (1928) Trans. Indiana Hort. Soc. 1927, 158-168.

(2) Loughnane, J. B. (1940) Journal Dept. of Agric. Ireland 37, 2, 370-382.

(3) Murphy, P. A. (1924) Journal Dept. of Agric. and Technical Instruction. Ireland 23, 1, 20-34.

(4) Murphy, P A., and McKay, R. (1927) Journal Dept. of Lands and Agriculture, Ireland. 26, 4, 295-305.

(5) Murphy, P. A. (1938) Journal Dept. of Agric. Ireland, 35, 1, 1-19.

(6) Nielsen, O. (1934) Tidsskr. for Planteavl 40, 1, 105-118. Abstract in Rev. App. Mycol. 13, 11, 1934.

(7) Whitehead, T., and Currie, J. F. (1931) Ann. App. Biol. 18, 4, 508-520.

(Received for publication on 25th January, 1941).

STUDY OF A ROPY MILK ORGANISM

By

L. Ó Droma, B.A., M.Sc. (Dairying), and M. Grimes, M.Sc., Ph.D.,
Department of Dairy Bacteriology,
University College, Cork.

That certain organisms are capable of producing a type of abnormal fermentation of milk, known as ropy or slimy, has long been noted. From the time of Ehrenburg (1840) and Pasteur (1857), various workers in the different countries have given attention to this problem which can be the cause of severe economic losses in practical dairying. Buchanan and Hammer (1), studied the causes of slimy and ropy milk in America and found that Alcaligenes viscosus (Bacterium lactis viscosum) was most often responsible for producing this condition in milk especially during the summer months. Among other organisms studied by these workers was Micrococcus pituitoparus, which had been previously described by Hohl (2) and later by Sato (3) who isolated it from slimy milk in Germany. Organisms of the Escherichia-Aerobacter group as noted by various workers—including Hammer (America) (4), Davis (England) (5), Grimes and Hennerty (Ireland) (6), can be the cause of serious outbreaks of ropy milk. Certain members of the S. lactis and other lactic acid streptococci as well as certain strains of the Lactobacilli, though relatively of little importance in the production of ropiness, have, however, been described in the literature from time to time as being associated with this type of fermentation.

During the past two years a slime-forming organism has been experienced in our laboratory, having been isolated :—

(*a*) From samples of ropy milk sent for examination by dairy farmers and city milk-vendors ;

(*b*) from the composite milk delivered at the College Creamery.

The history and nature of the occurrence of some of these ropy milks first attracted our attention and prompted the work undertaken here. It was noticed that a regular " outbreak " of ropy fermentation occurred in widely-separated parts of the country during the months of October and November, 1938, when an abnormally heavy rainfall caused severe flooding. One particular dairyman (Co. Tipperary) with a large herd experienced the trouble at intervals throughout these months, his entire supply of milk

going ropy before delivery at the creamery. During the same period a city milk supplier (Cork) suffered heavy losses when his customers rejected his milk on the plea that his previous deliveries had developed " stringiness."

The samples received from the cases here cited as well as others from like sources were found on examination by us to be similarly affected—the milk being very viscous and drawing out in long slimy threads when touched with a pipette or loop needle, but being otherwise normal in regard to colour and acidity. Direct microscopic examination and isolation in tryptone dextrose agar showed the causative agent, a micrococcus, to be identical in all cases. Further cultures of the organism, which when inoculated into sterile milk in the laboratory quickly develop a ropy fermentation, have been secured as a result of the routine investigation of the bacterial flora of the bulk milk delivered at the College Creamery.

As the micrococcus in the form in which it occurs in this country can be a cause of considerable annoyance as well as a source of heavy losses not only to the dairy farmer and milk dealer but also to the creamery, it was considered desirable to study its growth habits and requirements in detail. This was undertaken here principally with a view to suggesting methods for its effective control and elimination.

SYNOPSIS OF THE MORPHOLOGICAL, CULTURAL, BIOCHEMICAL AND OTHER CHARACTERISTICS OF THE ISOLATED ORGANISM

Morphology

Form :—Spheres, measuring from 0.75 to 1.5 microns in diameter. Elongated forms were observed in actively-growing cultures.

Arrangement :—Singly, in pairs* with a tendency in certain cultures to develop short chains of four to six units.

Staining Reactions :—Stains readily with the common stains. Gram-negative though some cultures were gram-variable.

Spores :—Not produced.

Capsules :—Non-capsulated.

Motility :—Non-motile.

*When the organisms were grown and examined in milk cultures the grouping was seen to be almost invariably in pairs.

CULTURAL CHARACTERS AT 21 DEGREES C.

Gelatine Colonies :—Small, circular, entire, white or whitish yellow, stringy when touched with needle.

Gelatine Stabs :—Good spreading growth on the surface, poor growth along lower part of puncture-line. Slight brown pigmentation was observed, mostly concentrated near the surface, after 14 days at 21°C. Incubation up to periods of four months showed the gelatine to be non-liquefied.

Agar Colonies :—Small, grey, very viscous. Sub-surface colonies much smaller than surface growths.

Agar Slant :—Abundant, whitish-yellow viscous growth.

Potato :—Good growth, yellowish grey, changing to a grey white colour, slimy, but with some cultures a dull dry growth was obtained.

Eosin Methylene Blue Agar :—Fair growth (b)

Tryptone Beef Extract Broth :—Turbid, with heavy greyish-white sediment. Very slimy.

Methylene Blue Milk (1 : 20,000) :—Reduction in two days followed by ropiness.

Litmus Milk :—Becomes viscous and slimy. No change in the litmus.

Plain Milk :—Growth in plain milk at different temperatures; 12°C., draws in slimy strings after 24 hours, no change in the pH.; 21°C., becomes viscous after 12 hours, with pronounced ropiness after 24 hours incubation. Examination after three months showed (i) that the slimy character still persisted, (ii) that the reaction had shifted slightly towards alkalinity, *viz.:* from pH 6.7 to 7.0 $\pm$ 1; 30° C. develops fair growth, not as viscous as at lower temperatures; 37° C., negligible growth, non-viscous.

BIOCHEMICAL FEATURES

Hydrogen Sulphide (using the peptone iron agar medium suggested by Levine and co-workers (7)): produced.

Nitrates :—Not reduced.

Indole :—Not formed.

(b) A culture of the organism was found growing on this medium as a contaminant of Aerobacter Aerogenes isolated from a supplier's milk.

Citrate Media :—Good growth. pH. changed from 6.9 to 7.8.

Uric Acid Media :—No growth.

Fermenting Power :—No action on sugars.

Blood Agar Media :- No evidence of haemolysis.

GROWTH CONDITIONS

Oxygen Relationship :—Organism is facultative; grows best aerobically.

Growth Temperature :—Grows almost equally well at temperatures ranging from 12°C. to 25°C. Only very slight growth observed at 37°C. Organism remains viable in suitable media over a long period at 0°C.

Heat Resistance :—Completely killed off in milk cultures by a pasteurisation temperature of 62.8°C. for 15 minutes.

DISCUSSION

The slime-former studied here is shown to have characteristics identical with those of Micrococcus pituitoparus in so far as this organism has been described in Bergey's Manual (8). Its power of utilising the citrate radicle as a source of carbon with its consequent good growth in Koser citrate medium (a character not hitherto described) is interesting as it shows a relationship, as regards habitat, to other soil and water bacteria. When the organism finds its way into milk and with the conditions favourable for its active growth, it seems to crowd out and almost entirely inhibit the development of other types of bacteria normally found present in this and other dairy products. (This was repeatedly shown by direct microscopic examination of a number of the samples of ropy milk submitted for investigation at our laboratory). The exact nature of the slime produced by this micrococcus in giving rise to ropy fermentation was not determined. It seems however, that the ropiness is not dependent on the development of capsules: most probably it is related to the peptonising action of the organism on proteins with a resultant formation of mucins. Finally it may be observed that while Alcaligenes viscosus may be of significance in causing ropy fermentation during the summer months, as was found to be the case in America, Micrococcus pituitoparus, at least in this country, can be a cause of trouble to milk producers and others during the winter and spring months.

CONTROL METHODS

Micrococcus pituitoparus was first isolated by Hohl (2) from decaying straw, before its relationship with ropy milk was recognised. Its characteristics in general are in keeping with a soil or plant habitat. Unlike Alcaligenes viscosus it has not been commonly met with in water. The widespread outbreaks of ropy milk fermentation such as the cases mentioned in this paper relate very strikingly with periods of heavy rainfall and flooded conditions generally. At such times plant and soil organisms would no doubt find their way through surface waters into streams and rivers, possibly also polluting wells in certain areas. These infected waters then become the harbourers and potential spreaders of the slime-forming organism. If animals chance to stand or wade in such water, the organisms may become attached to their flanks and udders, afterwards gaining access to the milk probably during the milking process. In certain cases the water, unpasteurised, may come into contact with dairy appliances and utensils. The straw and other bedding used in the byres may also provide a fruitful source of maintenance for the infection, contaminating the air and surroundings.

On the farm, therefore, with a view to the control and eradication of this causative agent of ropy milk, it is particularly necessary that due care be given:

(*a*) To the animals themselves, by preventing as much as possible their access to stagnant or flooded surface waters and by careful attention to the udder and flanks before milking.

(*b*) To the utensils, which must be thoroughly treated by boiling or steaming (to kill off contaminating non-spore forming organisms).

(*c*) To the surroundings, by a general cleaning up and disinfection.

Finally it may be of use to point out that where the organisms have gained recent entry into milk, a temporary solution is provided by pasteurisation, 76°C. flash or 62.8°C. for 15 minutes, as micrococcus pituitoparus easily succumbs to heating.

SUMMARY

1. An organism associated with ropy fermentation of milk in this country, particularly during the winter and spring months has been studied and identified as Micrococcus pituitoparus.

2. Certain hitherto unrecorded characteristics of this organism have been noted.

3. Methods for its control and elimination have been suggested.

REFERENCES

1. Buchanan, R. E. and Hammer, B. W. (1915), Iowa Agr. Exp. Sta. Res. Bul. 22.
2. Hohl, (1906). Jahrb. der Schweiz, 22, 439.
3. Sato, (1907). Cent. F. Bakt., II Abt., 19, 27.
4. Hammer, B. W. (1928). Dairy Bacteriology, New York ; J. Wiley & Sons.
5. Davis, J. G. (1935). J. Min. of Agric., Vol. XLII, No. 7.
6. Grimes, M. and Hennerty, A. J., (1931). Scient. Proc. R. D. S. Vol. 20, No. 9.
7. Levine, M., Epstein, S. S. and Vaughn, R. H. (1934). Amer. J. P. Health, 24, 505.
8. Bergey, D. H. (1939). Manual of Determinative Bacteriology.

(Received for publication on 24th September, 1940).

FORMALIN ADULTERATION IN MILK AND ITS DETECTION IN THE RESULTING BUTTER

By

G. T. Pyne, M.Sc., A.R.C.Sc.I., F.I.C., Ph.D., Dairy Chemistry Department,

and

J. Lyons, A.R.C.Sc.I., N.D.A., N.D.D., M.Sc., Dairy Technology Department,
University College, Cork.

The question has arisen whether it is possible to detect the use of formaldehyde as a milk preservative by one or more creamery suppliers by means of a subsequent examination of the butter made from the mixed milk. Difficulties to such a method of control are firstly the very low concentrations of formaldehyde likely to occur initially in the butter, and secondly the possibility of a more or less rapid disappearance of the reactive preservative, even where originally present, before an examination can normally be carried out. As regards the first point, on the assumption that only one supplier in one hundred employs formaldehyde (commercial 40 per cent. formalin) at the rate of, say, 1 teaspoonful per 10 gallon can, then the final concentration of preservative in the mixed milk might not exceed 1 part in 4 millions, and in the serum of butter manufactured from such milk need not amount to more than half that quantity. Such small amounts of formaldehyde lie close to the limits of sensitivity of the best routine tests and could only be detected, if at all, provided that no further diminution of preservative occurred during the storage of the butter prior to testing. The degree of persistence of formaldehyde in cold-stored butter is therefore a matter for examination before any general recommendations can be made in regard to the feasibility of this mode of controlling the possible malpractices of certain suppliers.

Preliminary experiments on stored butters containing very small amounts of formaldehyde suggested that the rate of disappearance of this preservative was considerable and made it appear desirable to examine the matter systematically. For this purpose churnings were made from a series of creams containing 2, 5, 15, and 50 parts per million of formaldehyde respectively and the resulting butters were stored at about 2°C. and tested at intervals for this preservative (applying the Shrewsbury-Knapp method to the serum obtained by centrifuging the butter melted at 40°C.) As the cream churned contained approximately 50 per cent. fat, and as about

one-half of the butter serum arose from enclosed butter milk, the initial concentrations of formaldehyde in the butter sera were about equal to those of the creams used, *i.e.*, from 2 to 50 parts per million. The lowest of these concentrations was probably higher than any likely to be found in practice in the serum of freshly made butter which had suffered adulteration through the action of one or two suppliers. The study of the behaviour of such concentrations on storage was, however, of value in establishing practical limits for the detection of any quantities of formaldehyde ever likely to occur.

Periodic examination of the stored butter showed that all samples lost formaldehyde rapidly but at rates which depended on its initial concentration. The butter containing initially 2 parts per million serum lost the bulk of its formaldehyde in 3-4 days and no longer gave the reactions of this preservative after about a fortnight. That containing initially 5 parts per million serum also fell off rapidly but was still just detectable after 3 months, while the two samples with 15 and 50 parts per million reacted even after 6 months. It appears then that while relatively gross adulteration of butter with formaldehyde can be detected even after prolonged storage, the minute amounts likely to occur as a result of the use of this preservative by a small minority of creamery suppliers is likely to escape detection if the sample is about a fortnight old (perhaps even earlier) at the time of examination.

As a matter of interest attempts were made, with the same series of butters, to obtain indirect evidence of the former presence of formaldehyde, where it was no longer directly detectible, by an estimation of the formic acid content of the samples. This acid is a frequent, and in the present case not improbable, end-product of formaldehyde. The examination did not however in general yield results which could be positively interpreted as indicating the former presence of formaldehyde, owing largely to the invariable presence of formic acid as a normal constituent in the original milk and its frequent and somewhat erratic production subsequently by certain types of bacterial action.

It must be concluded then that the detection of the use of formaldehyde as a preservative by an occasional milk supplier is not readily practicable through a subsequent examination of the butter. It is, in fact, much more simply, accurately and directly detected by examining the creamery milk supply from time to time. The individual supplier's samples are unfortunately not very suitable for this purpose owing to the practice of preserving them with bichromate, a substance whose presence interferes with the simpler forms of the formaldehyde test. The daily drip sample is not however, preserved in this way and can readily be utilised for the control of formaldehyde adulteration. An occasional check of this sample by the simple and sensitive Shrewsbury-Knapp Test, which is capable of detecting 1 part of formaldehyde in 5 millions should suffice to reveal, in all probability, the use of formaldehyde by even one supplier in a hundred. In the event

of a positive reaction being obtained, or of the use of formaldehyde being strongly suspected even in spite of a negative reaction from the bulk sample, it will be a simple matter to trace the offending party or parties by taking a series of subsamples or individual samples for test, on a subsequent occasion.

The Shrewsbury-Knapp (Analyst, 1909, *34*, 12) test recommended is simple and should not be beyond the capabilities of persons employed in creameries. The reagent consists of concentrated hydrochloric acid to which is added 2 per cent. of a 5 per cent. solution of nitric acid. 10 cc. of this reagent *freshly mixed* are added to 5 cc. of the suspected milk in a test-tube, vigorously shaken, and then held for 10 minutes at 50°C. (122°F.) and rapidly cooled. A violet colour, slight or deep according to amount, indicates the presence of formaldehyde. A blank estimation on formaldehyde-free milk should be made at the same time in order to make it possible to distinguish between samples completely free from this preservative and those which contain definite traces.

The writers would like to express their indebtedness to Mr. M. Ward, Senior Inspector, Department of Agriculture, for drawing their attention to this problem.

(Received for publication 18th September, 1940).

FACTORS INFLUENCING THE COMPOSITION OF MILK

The quality and composition of milk are subject to considerable variation according to the conditions under which the milk is produced. In view of this fact legislation has been enacted in most countries with a view to ensuring that the quality of milk sold for human consumption is not below certain specified standards.

In this country, under the Milk (Percentage of Milk-fat and Milk-solids) (No. 2) Regulations, 1936, any article of food sold as whole milk must contain not less than 3 per cent. of fat and not less than 8.5 per cent. of solids-not-fat. It is, accordingly, illegal to sell milk the quality of which falls below these standards, irrespective of the cause. Even though the deficiency may be due to the incapacity of the cow to produce milk of the required standard, this fact does not absolve the seller from liability. The percentage of fat is subject to greater variation than is the percentage of solids-not-fat and persons engaged in the production of milk should be conversant with the more important factors which may produce such variation, so as to ensure that the quality of the milk produced does not fall below the prescribed standard. These factors are as follows :—

Interval between Milkings

This is perhaps the commonest cause of variation in the proportion of fat in milk. As a rule, the longer the interval between each milking the greater the yield and the lower the fat percentage. Thus the lower proportion of fat in morning milk may be ascribed to the long interval which has usually elapsed since the previous milking. Where cows are milked at twelve-hour intervals little variation occurs in the fat-content of the milk produced and producers should, accordingly, endeavour as far as practicable to arrange to have the intervals between milkings as nearly equal as possible.

Age of Cow

This factor exercises but a slight influence on the proportion of fat in milk. Investigations have shown that there is a tendency for the fat-content in milk to increase slightly from the first to the third lactation. Very little change occurs during subsequent lactations until the effects of old age become apparent, when a decline in the proportion of fat in the milk invariably occurs.

Breed

The average fat-content of the milk produced by the various breeds differs considerably. Generally speaking, Jerseys and Kerries produce the richest milk, whilst the milk of the Friesian breed is usually least rich in fat content. The capacity to produce rich or poor milk appears to be a hereditary factor influenced by both parents. Considerable improvement in the quality of the milk may be effected by breeding from the best animals only, and for this purpose systematic and careful milk recording is essential.

Period of Lactation

The fat-content of milk usually tends to decrease slightly up to about the fourteenth week after the date of calving, but unless the majority of the cows in the herd calve about the same time the effect of this factor is very slight. Subsequently the percentage of fat shows an upward trend which continues to the end of the lactation.

Seasonal Variation

The quality of milk is to some extent subject to seasonal variation. Generally, from October to March it is richer in fat than during the remainder of the year. In addition to the lower fat percentage which normally occurs during the period from April to September, an appreciable decrease also takes place when the cows are put out to pasture in early summer. At that period the yield usually increases and the quality is reduced temporarily. After a short interval, however, the fat-content reverts to its former level.

First and Last Milk

The first milk from the udder is invariably low in fat-content, while the reverse is true for the last milk drawn, generally known as the "strippings." The higher the yield the greater the variation in fat-content between the first milk and "strippings." Thus the percentage of fat in the milk may be increased by excluding the fore-milk and including the "strippings."

Effect of Food

Although many farmers hold the contrary view, it has now been proved that, provided cows are reasonably well fed, the nature of the food consumed has very little effect on the quality of the milk yielded. Variations attributed to food will almost invariably be found to be due to other reasons, *e.g.*, seasonal variation, period of lactation, etc.

Individuality of the Cow

Cases have been noted where the percentage of fat in the milk of certain cows, fed and maintained under conditions similar to those obtaining for the remainder of the herd, regularly fell below the standard prescribed under

the Sale of Food and Drugs Acts. In the absence of any of the more important factors such a deficiency can be ascribed only to the individuality of the animal. Individual cows known consistently to produce milk of a poor quality should be removed from the herd.

Miscellaneous Causes

A number of other less important factors may be responsible for variations in the quality of milk. Among these are change of milkers, sickness, fright or excitement of the animal during milking, oestrum or heat period, etc.

Solids-not-Fat

Most of the factors which influence the percentage of fat in milk also affect, to a lesser extent, the percentage of solids-not-fat. There is now a considerable amount of experimental evidence to show that the incidence of mild mastitis accounts for a very high proportion of the cases where the percentage of solids-not-fat is persistently low. Precautions directed towards reducing the incidence of this disease in the herd will, therefore, help materially in keeping the percentage of solids-not-fat above the prescribed legal Minimum. (See Leaflet No. 107—Milk Fever and Mammitis in Cattle).

In practice the foregoing factors will never operate simultaneously in regard to the herd as a whole nor in fact in regard to any considerable proportion of it, and where a herd is judiciously and carefully managed the quality of the milk should not fall below the reasonable standard prescribed under the Sale of Food and Drugs Acts. A study of the factors which are amenable to control will show that in order to obtain milk of a consistently high quality the owner must take certain precautions in the management of his herd. Thus, care should be taken with a view to ensuring that the herd should consist as far as possible of cows of high butter-fat producing potentialities. Milkings should as far as practicable take place at intervals as nearly equal as possible; the "strippings" should always be included in the yield; and at all times care should be taken to mix thoroughly the aggregate milk from the herd in order to counteract the low fat-content which may possibly occur in the milk of individual cows.

Finally, producers are advised where possible to become members of a recognised Cow-testing Association, so that for a small annual expenditure they can obtain reliable information as to the quantity and quality of the milk produced by each cow in their herds.

June, 1940.

POTATO SILAGE

Ireland is proverbially associated with potato growing and few, if any, countries are capable of producing equally heavy yields of this crop. Yet it is doubtful if the potentialities of the potato as a food for farm stock and particularly for pigs are fully appreciated by Irish Farmers. Again and again it has been shown that 4 lb. of cooked potatoes in a mixed pig ration is practically equivalent to 1 lb. of maize meal. Not only does this relationship hold in a normal mixed ration but feeding experiments conducted at the Department's farms have shown that pigs whose ration consisted of upwards of 60 per cent. of potatoes, on a meal equivalent basis, and who consumed during the fattening period, an average of about a stone of potatoes per head daily, were fattened more economically than pigs in whose diet potatoes were entirely replaced by meals and compared favourably both as regards progress and quality with the latter animals.

Equally good results have been obtained from the use of potatoes, supplemented with separated milk and meal, in the feeding of poultry.

Yields exceeding 20 tons per statute acre have been obtained in the potato-growing districts of this country. Similar yields could scarcely be expected where growers have not reached the same degree of expertness, but with such heavy yielding varieties as Arran Banner the production of fourteen to sixteen tons per acre should present no serious difficulty, in other words the equivalent for feeding purposes of up to four tons of maize.

In view of these facts the growing of potatoes on a largely increased scale is obviously desirable. Equally desirable is the proper storage of the potatoes and the prevention of loss in feeding value until they are required for use.

In our climate potatoes may be stored in pits during normal winters without risk of damage by frost but, notwithstanding careful selection at time of pitting a certain amount of loss through decay and disease is inevitable. The most serious loss in feeding value takes place through sprouting in early spring. This can be partly prevented by frequent handling and removal of the sprouts but a stage arrives when it is no longer possible to preserve the tubers by ordinary means and on most farms the produce of one year's crop is exhausted long before the following season's crop is ready for use. Probably the most economical method of preserving potatoes to bridge this gap is by converting them into silage, in other words by cooking them and afterwards storing them for future use. While this applies particularly to the

sound tubers which are usually pitted immediately after lifting, the preservation of the " waste " potatoes at this time is also a matter of importance. On farms where potatoes are grown in quantity and where lifting takes place in the space of a week or two, there becomes available a considerable quantity of small, diseased and damaged tubers which cannot be consumed at once and which frequently go to waste. These can be preserved in the form of potato silage. " Black " potatoes, *i.e.*, those affected with blight, can be included with other " waste " potatoes but the silage should be made soon after they are lifted and before decay proceeds further. Frosted tubers may also be used before decay sets in.

Farmers who have made grass ensilage are aware of the comparative simplicity of this operation and of the confidence with which the job is tackled after the early doubts have been surmounted. The making of potato silage is a much simpler operation and one which scarcely leaves room for failure. Certain conditions are necessary to ensure success but as already indicated potato silage is simply cooked potatoes stored away in a suitable receptacle until required for use.

It is usual to refer to this receptacle as a " silo " but this does not imply an elaborate or costly construction. Probably the best form of silo is a trench four feet deep and three feet wide at the top, excavated on dry, sloping ground, and lined preferably with concrete or, failing this, with rough slabs of wood. The trench should run in the direction of the slope and should be so constructed that it is a few inches wider at the top than at the bottom. Although there is usually very little seepage from the potatoes a drainage opening should be provided at the lowest point mainly as an outlet for rainwater which may gain access to the pit when not in use.

Where the trench is to be lined with concrete the lining, including the covering of the floor, should be at least 3 to 4 inches thick and the sides and ends should be raised a few inches above the level of the ground. The concrete may consist of 1 part of cement to 8 parts clean gravel and should be well tamped down at filling. In order to prevent bulging as a result of the tamping, the forms or wooden framework employed in putting down the concrete should be strong and well braced. The concrete should be finished off with a light coat of fine cement plaster. All corners and angles should be slightly rounded off.

Potato silage in contact with earth or clay suffers considerable deterioration and it should not, therefore, be made in unlined pits.

An existing farm building may be availed of to construct an inexpensive silo. The outer wall of the building, or perhaps the angle of two adjacent walls may be used and the required space provided by erecting the further necessary concrete walls to a height of three or four feet. Similarly a suitable

container may be made indoors in a pen or loose box. Indeed an improvised silo can be constructed by placing a number of stout planks such as old railway sleepers across a corner of a concrete pen or loose box and binding them firmly in position. The triangular space so provided will conveniently store a few tons of silage. Whether a new silo is being constructed or an existing building adapted for the purpose the inside walls should be plastered smooth and in all cases precautions should be taken to prevent ground water soaking into the silo.

For ensiling small quantities of potatoes, wooden or metal barrels or any similar containers may be used provided they are clean and sound.

The size of the silo will naturally depend on the quantity of potatoes available for treatment but it may be assumed that a cubic yard will hold approximately 15 cwt. of silage or that a sloping " trench " or " trough " four feet deep and three feet wide, of the kind already described, will accomodate in each yard of its length, approximately one ton of silage.

Soil contains many organisms which might set up decay in potato silage. They may possibly be destroyed in the cooking process but nevertheless the tubers should be thoroughly washed before cooking. In any event dirty potatoes produce an unattractive looking silage whereas when properly made it should both in appearance and otherwise bear comparison with freshly-cooked potatoes.

After washing, the potatoes should be properly cooked, either by steaming or by boiling. The former method is applicable to larger farms where steam under pressure is available. Portable outfits consisting of potato washer steam generator and cooker have been provided for this purpose and although they may be difficult to procure in present circumstances, Co-operative Societies particularly in potato-growing districts might under normal conditions acquire one or more of these outfits on behalf of their members. Special farm wagons have been provided on the Continent for the steaming of potatoes and the following particulars in this connection are of interest.

> " The wagon consists of a long box on four wheels. A steam pipe, a foot longer than the wagon, is laid in the bottom of the wagon, extending about a foot beyond the tail board. The steam pipe consists of 1 inch gun-barrel piping, the inner end of which is closed and the end extending beyond the wagon fitted with a screw or coupling to take the steam pipe from the steam generator. Three rows of holes ¼ inch in diameter and a foot apart are bored in the part of the pipe which lies inside the wagon. One row of holes is situated on each side of the pipe and one on top. The wagon is filled with the washed potatoes which are covered with thick, wet sacks. The top is closed with a stoutly made, well-fitting lid which is pressed down by means of chains stretched across

it and attached at each end to the sides of the wagon. Stout wooden wedges are driven between the chains and the lid, to press the latter down firmly. The wagons require to be well constructed, preferably of tongued and grooved wood, to prevent waste of steam. The wagon filled with potatoes is brought to the steam generator (usually a creamery or potato alcohol factory) where the steaming is performed by attaching the steam pipe of the generator to that of the wagon and turning on the steam."

It is suggested that Co-operative Societies might have a few of these comparatively inexpensive wagons constructed for loan to members. Alternatively individual farmers might construct on similar lines a box measuring 4′ x 3′ x 3′ and capable of holding about a ton of potatoes which could be mounted on a hay bogie and brought to the steam generator at a creamery, etc.

In the absence of more elaborate facilities cooking can be done with reasonable expedition in ordinary farm boilers or " tip over " boilers in quantities of about 3 cwt. at a time. Cooked in this way the potatoes should be well drained before being placed in the silo.

Whatever method of cooking is adopted the potatoes should be placed in the silo while still hot and tamped in till they form a solid mass free from air spaces.

Where the silo is of such dimensions that the filling will extend over a number of days it should be filled in sections, each section being filled in one day. A partition of boards should be placed across the silo and the section so partitioned off filled. The following day the partition can be shifted back the desired distance and filling resumed.

The surface of the heap should be smoothed off and covered with wet sacks on top of which should be placed a layer of earth about six inches thick or other suitable covering. Where it is more convenient, boards may be laid close together on top of the sacks and well weighted down with stones, etc. Where weighted boards are to be used the top of the silage requires to be level and the silo should not be filled above the level of the walls. In the case of trench silos, where a covering of clay will usually be the more convenient, the silage may be heaped up over the level of the silo and rounded off.

Roof

Potato silos constructed in the open require to be roofed to protect the silage from rain. In the case of trench silos the roof may take the form of a good covering of thatch fastened down in the usual way with scollops.

binder twine or light coir rope. For overground silos a lean-to roof of any ordinary roofing material will usually be the most convenient type.

Feeding

Potato silage may be used for feeding purposes immediately after being made. As the main purpose is to preserve potatoes to meet the lean season from March to September when pig feeding is largely dependent on the use of imported maize it is assumed that generally speaking the silage would not be used for some time. It will, however, keep indefinitely and it may be fed to farm animals and to poultry just as would freshly cooked potatoes. It is similar to the latter in feeding value and because of the slight fermentation which has taken place, is perhaps somewhat more appetising.

As deterioration and the growth of moulds takes place in potato silage exposed to the air for some time, it is desirable that the quantity required each day should be removed from the whole of the exposed surface rather than from a portion only.

Potato silage is a practical proposition in normal times. It is much more so at present having regard to the cost of the concentrated foods for which it may so readily be substituted in the feeding of farm stock but particularly pigs and poultry.

Farmers who have potatoes available for stock feeding from the present season's crop are, therefore, strongly advised to make arrangements for ensiling such portion of them as cannot be used during the early winter. It is also suggested that an increased area should be devoted to the potato crop during the coming season with the same object in view.

(Issued as Special Leaflet No. 9).

NOTES ON THE EMERGENCY POWERS (No. 53) ORDER, 1940, as amended by the Emergency Powers (No. 53) Order, 1940, (Amendment) Order, 1941, relative to Cultivation of Land in 1941

1. The Emergency Powers (No. 53) Order, 1940, as amended, provides, subject to certain exceptions which are mentioned in paragraphs 10 and 11 of these Notes, that every occupier of ten or more statute acres of arable land shall in 1941 cultivate, in accordance with proper methods of husbandry, an area equivalent to at least one-fifth of such land.

2. The Order takes effect notwithstanding any covenant, agreement, condition or provision as to the user of the "holding" and no such covenant etc., shall operate so as to penalise, impede or interfere with the cultivation required by the Order. Land let on the eleven months' system comes under the Order and the obligation to cultivate the requisite area in respect of such land lies on the person rated or liable to be rated for it, or, if he is absent from the State, on such other person as is authorised to make lettings on his behalf.

3. *Definition of Occupier.*—An occupier is defined as the person who is rated or liable to be rated in respect of the land. If, however, the person so rated or liable to be rated is absent from the State such other person as is authorised by him to make lettings on his behalf is regarded as the occupier for the purposes of the Order.

4. *Definition of Holding.*—For the purposes of the Order an occupier's "holding" means all the arable land (*i.e.*, land capable of being tilled) in his occupation in the State. If he has two or more farms he must cultivate at least one-fifth of the total area of arable land comprised in all the farms but the selection of the farm or farms for the performance of the requisite cultivation is left to his discretion.

5. *Arable Land.*—"Arable" means capable of being tilled. Building lands, if arable, come therefore within the provisions of the Order as do also demesnes, save parts thereof on which timber would interfere with the cultivation or harvesting of crops.

6. *Non-arable Land.*—The following are examples of land which will

be regarded as non-arable and, therefore, not within the scope of the Order :— rough mountain grazing, unreclaimed bog, sand dunes, land regularly subject to flooding, land under timber, land recently planted for forestry purposes and land on which the cultivation and harvesting of crops would be interfered with by timber.

7. *Meaning of " Cultivation " or " Tillage."*—Cultivation or tillage comprises ploughing together with the subsequent operations necessary for the production and harvesting, in 1941, of a crop in accordance with proper methods of husbandry It should, however, be observed that, for the purposes of the Order (i) the growing of rape does not rank as cultivation ; (ii) land sown with oats, barley or wheat and also with grass seed or with grass and clover seeds will be held to be cultivated, but if it is sown only with grass seed or only with grass and clover seeds, it will not be regarded as cultivated, and (iii) first or second year's rotational grass, whether mown or grazed, does not rank as a cultivated crop. Apart from these limitations the choice of crop to be grown on land cultivated in compliance with the requirements of the Order is left to the discretion of the occupier. Moreover, any part of a holding sown in 1940 with a Winter cereal for harvest in 1941 will be regarded as having been sown in 1941.

8. *Orchards.*—Orchards, if properly planted and managed, will be regarded as cultivated but lands which are in grass and on which the fruit trees are unreasonably wide apart or on which the fruit trees have not received attention as regards spraying, etc., will not be regarded as cultivated.

9. *Conacre tillage and allotments.*—If an occupier arranges for the cultivation of his holding in 1941 either in conacre or by allotment holders such cultivation will, for the purposes of the Order, be regarded as cultivation by the occupier.

10. *Exceptions or exemptions.*—As indicated in paragraph 1 of these Notes the Order does not apply to a " holding " comprising less than ten statute acres of arable land (see also paragraph 4 of these Notes). Neither does it apply to a " holding " which is or forms part of a public park, public recreation ground or an aerodrome. Occupiers of such lands are, therefore, under no legal obligation to cultivate any part thereof, and it is not necessary for them to make application for exception.

11. *Permissive exceptions or exemptions.*—The Minister for Agriculture may, on the application of the occupier, declare a " holding " or a part thereof to be excepted from the provisions of the Order if he is satisfied that the entire " holding " or a part thereof

(*a*) is required in the year 1941 for the purpose of carrying on of an industry other than agriculture, and that its use for such purpose

would be of greater service in national interests than its cultivation, or

(*b*) has been required and regularly used in the year 1940, and is required in the year 1941 for the accommodation, for periods not exceeding ten days at a time, of stock, intended for disposal at auctions, fairs or markets, or for shipment, or for the accommodation, as aforesaid, of stock held over from auctions, fairs or markets, or

(*c*) has been required and regularly used in the year 1940, and is required in the year 1941 for the accommodation of cattle or sheep intended for slaughter within fifteen days of their being accommodated on such holding, or

(*d*) has been required and regularly used in the year 1940, and is required in the year 1941 for the maintenance of a stud of high-class thoroughbred horses consisting of breeding animals, foals, and yearlings, or

(*e*) has been regularly used in the year 1940 as the track of a racecourse or as a paddock, ring or other enclosure, adjacent to the stand or stands of a racecourse, and is required for that purpose in the year 1941, or

(*f*) has been required and regularly used in the year 1940 as a track for the training of racehorses by a trainer licensed as such by the Turf Club or the Irish National Hunt Steeplechase Committee, and is required for that purpose in the year 1941, or

(*g*) has been regularly used by an agricultural or industrial Society as their Show Grounds, and is required for that purpose in the year 1941, or

(*h*) is let for the year 1941 to, or is owned by, a club, the main object of which is the promotion amongst its members of any outdoor game played between two or more persons, which is affiliated to or recognised by the governing body of that game in Ireland, and has been regularly used by such club for the playing of such game in the year 1940, and is required by such club for that purpose in the year 1941, or

(*i*) has been used by a college or school in the year 1940 as a playing field, and is required for that purpose in the year 1941.

12. *Application for declaration of exception.*—Applications for declaration

of exception must be made not later than 2nd December, 1940, on Form T.I. which may be obtained from the Department. Where an applicant is a company, club or other association the application may be made by the Chairman, Secretary, or duly authorised agent. In many cases, lands used for industrial purposes or as an accommodation or butcher's paddock, a sports ground, playing field or show ground constitute the entire " holding " and comprise less than ten statute acres of arable land. In such a case the lands do not come within the scope of the Order and no application for their exception is required. If, however, lands so used form only part of the " holding " or include ten statute acres or more of arable land, a declaration of exception must be sought by the occupier if he desires relief from his obligation under the Order to till at least one-fifth of all the arable land in his occupation. The onus of proof that land should be excepted from the provisions of the Order lies on the occupier and he will not be relieved of his obligation to cultivate simply by the fact that he has made an application for exception.

13. *Lands not used for the purpose for which they were excepted.*—A declaration of exception is, of course, only valid in case the lands are used in 1941 for the purpose for which the declaration is granted. An occupier who obtains a declaration of exception in respect of all or a portion of his lands but who does not use them in 1941 for the purpose for which they were excepted must therefore till them, or till in respect of them, to the extent prescribed by the Order.

14. *Requirement of the Order in case part of a " holding " is excepted.*—If the Minister has declared that a portion of a " holding " comes within one or more of the exceptions set out in paragraph 11 of these Notes, the acreage to which the Order applies is the arable land comprised in the residue of the " holding." Thus, for example, a person occupying one hundred acres of arable land, of which thirty acres are excepted, would, for the purposes of the Order be regarded as occupying not more than seventy acres of arable land. If, after allowing for the excepted portion, the residue of arable land in the " holding " does not amount to at least ten statute acres no part of the " holding " need be cultivated in order to comply with the requirements of the Order.

15. *Inspection of lands.*—Any person duly authorised by the Minister for Agriculture may, for the purposes of the Order, enter on and inspect any land and no one may lawfully obstruct or interfere with any person so authorised when he enters on or is inspecting the land.

16. *Penalties for non-compliance with the provisions of the Order.*—Failure on the part of an occupier to comply with the provisions of the Order constitutes an offence under the Emergency Powers Act, 1939, (No. 28 of 1939) and renders him liable to a fine of up to £100 or, at the discretion of the

Court, to imprisonment for a term of up to six months or to both such fine and such imprisonment.

Moreover, if, on or after the 14th day of February, 1941, the Minister for Agriculture is satisfied that an occupier has not taken reasonable steps towards cultivating one-fifth of his holding, the Minister may enter on the land and cultivate it or any part thereof or arrange for any person to do so on such conditions as the Minister may direct.

REPORT OF THE SEED PROPAGATION DIVISION, 1940.

As in previous years the bulk of the barley propagations and other investigational work was carried out at the Cereal Station, Ballinacurra, Co. Cork, in close collaboration with Messrs. A. Guinness, Son & Co., Ltd., at whose Experimental Maltings, the malting Tests were conducted. The work consisted of the usual pure line propagations, large scale variety, half drill strip and other experiments.

Pure line propagations of Black Tartary Oats were maintained at the Cereal Station and extension plots of Victory II and Ardri were grown in the neighbourhood of Ballinacurra.

WEATHER CONDITIONS.

The weather during January was dry, but exceptionally frosty, consequently little field work could be done. In February heavy rains were experienced, the rainfall for the month amounting to almost six inches. March being dry and harsh enabled field cultivations to be pushed ahead. Cereal sowing became general as the month progressed. The earlier weeks of April were also harsh and cold; drying winds and night frosts during this period did considerable damage to some crops. The latter half of the month was warm and mild with frequent showers which resulted in very much improved crop growth. During May and June a prolonged drought occurred. In spite of this, however, crops in general made satisfactory progress. July was warm, but showery, and in many instances early sown cereal crops were harvested towards the end of the month. August and September were notably dry and warm consequently the harvesting and storage of cereals were completed, under ideal conditions, much earlier than normal. The yield and quality of all grain crops were reported to be exceptionally good.

BARLEY.

The method adopted in 1929 in the selection of Spratt-Archer 37 No. 8 was again adopted in the selection of Spratt-Archer 37 No. 8 and Spratt-Archer 37 No. 4. This method consists of sowing five grains from every fifth plant of a single line in the preceding year. The pure line is thus composed of twenty-five, five grain lines. Each of the other varieties was propagated by taking the requisite amount of seed from the single line grown in 1939.

In addition to the pure lines mentioned above, fifty single plant selections were cultivated in the Old Cage at the Cereal Station, Ballinacurra.

These were as follows :—

Spratt-Archer 37/6, Spratt-Archer 37/6 No. 7, Spratt Archer 37 No. 3 H.9, Spratt-Archer 37/9, Archer Goldthorpe 4/5/1, Spratt, Archer, Goldthorpe, Old Irish, Burton Malting, Victory, D.S.K. Binder, Plumage-Archer, Duck Bill, Hybrid No. 1 C, Hybrid No. 4 A, Hybrid No. 4 B. 1, Hybrid No. 7, Black Himalayan, Black Russian, Kenia, Neils Franchen, Naked Barley, Golden Archer 1, Golden Archer 2, Goldberg, Spratt-Archer 37 No. 4 x July Six-Rowed 16/2, Spratt-Archer 37 No. 3 x Victory I, Spratt-Archer 37 No. 3 x Victory 2, Spratt-Archer 37 No. 3 x Victory 5, Glabron, Pearl, Donegal Six-Rowed, July Six-Rowed, Beaven's F. 112, Beaven's 49/14/3, B. 244, Hybrid 4 B. 1 x Golden Archer 1, Spratt-Archer 37/9 x Golden Archer 2 (Bulk), Spratt-Archer 37/9 x Golden Archer 2 No. 1, Spratt-Archer 37/9 x Golden Archer 2 No. 2, Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2 (Bulk), Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2¼, Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2½, Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2 No. 2, Spratt-Archer 37 No. 3 H. 9 x Hybrid 4 B. 1 (Bulk), Spratt-Archer 37 No. 3 H. 9 x Hybrid 4 B. 1 No. 1, Spratt-Archer 37 No. 3 H. 9 x Hybrid 4 B. 1. No. 2, Tschermack Brewing, Maja.

Garden Plots were propagated in Rosehill North Paddock.

Spratt-Archer 37 No. 3 (25 lines).
Archer.
D.S.K. Binder.
Kenia.
Golden Archer 2.
Spratt-Archer 37 No. 4 x July Six-Rowed 16/2.
Spratt-Archer 37 No. 3 H. 9.
Spratt-Archer 37 No. 3 x Victory 1.
Spratt-Archer 37 No. 3 x Victory 2.
July Six-Rowed.
Hybrid 4 B. 1 x Golden Archer 1.
Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2 (Bulk).
Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2, No. 2.
Spratt-Archer 37 No. 3 H. 9 x Hybrid 4 B. 1 (Bulk).
Spratt-Archer 37 No. 3 H. 9 x Hybrid 4 B. 1, No. 2.
Spratt-Archer 37/9 x Golden Archer 2 (Bulk).

Spratt-Archer 37/9 x Golden Archer 2, No. 1.

Spratt-Archer 37/9 x Golden Archer 2, No. 2.

Tschermack Brewing.

Maja.

Spratt-Archer 37 No. 3 H. 9 (Smooth Rachilla).

Field Plots of the following varieties were grown at Ramhill South Farm :—

July Six-Rowed.

Spratt-Archer 37 No. 3.

Archer.

Golden Archer 2.

Spratt-Archer 37 No. 4 x July Six-Rowed 16/2.

Hybrid 4 B. 1 x Golden Archer 1.

Kenia.

D.S.K. Binder.

First Pedigree Plots were sown on the farm of J. H. Bennett, Ltd., at Ramhill South Farm.

Spratt-Archer 37 No. 3	4 acres.
July Six-Rowed	1 acre.
Golden Archer 2	1 „
Archer	1 „
Spratt-Archer 37 No. 4 x July Six-Rowed 16/2	1 „
D.S.K. Binder	½ „

The produce of these plots will be available in 1941 for further propagations and Large Scale Variety Experiments.

Second Pedigree Plots of Spratt-Archer 37 No. 3 were grown under contract with the following farmers in the neighbourhood of Ballinacurra :—

	Brls.	Sts.
M. Kelleher, Geragh, Ballinacurra	6	4
R. Scanlon, Geragh, Ballinacurra	6	0
P. McCarthy, Castleredmond, Ballinacurra	3	2
J. Leahy, Innegrega, Ballinacurra	5	6
P. Wallace, Ballinabointra, Carrigtwohill	5	0
Total ..	25	12

The produce of these plots will be available for distribution as nucleus stocks of pedigree seed in the spring of 1941.

For a number of years the Department has had in operation a scheme under which nucleus stocks of Pedigree Spratt-Archer barley are distributed each year to members of the Irish Maltsters' Association and others interested in seed barley distribution. Those who obtain such stocks undertake to have them grown with reliable farmers; to buy the produce, if suitable for seed purposes, and distribute it to growers in the following season. Under this Scheme 402½ barrels of Spratt-Archer 37 No. 3 were distributed to the following :—

	Brls.	Sts.
Messrs. Minch, Norton & Co., Ltd., Athy	50	—
Messrs. Minch, Norton & Co., Ltd., Stradbally ..	18	—
Messrs. Minch, Norton & Co., Ltd., Nenagh	18	—
Messrs. Minch, Norton & Co., Ltd., Bagenalstown .	15	—
Messrs. Minch, Norton & Co., Ltd., Barracore ..	14	-
Messrs. Robert Gibney & Co., Ltd., Maryboro' ..	10	—
Messrs. The Birr Maltings, Ltd., Birr	10	—
Messrs. F. A. Waller & Co., Ltd., Banagher	12	—
Messrs. George Read & Co., Ltd., Roscrea	11	—
Messrs. The North Tipperary Maltings, Ltd., Nenagh ..	18	—
Messrs. A. J. Reeves, Ltd., Athgarvan, Co. Kildare ..	5	—
Messrs. J. & A. Tarleton, Ltd., Tullamore	10	—
Messrs. P. & H. Egan, Ltd., Tullamore	25	—
Messrs. D. E. Williams, Ltd., Tullamore	80	—
Messrs. N. Hardy & Co., Ltd., Dundalk	10	—

	Brls.	Sts.
Messrs. W. J. O'Keeffe & Sons, Faythe Maltings, Wexford	10	—
Messrs. Joshua Watson & Co., Ltd., Leighlin Bridge ..	10	—
Messrs. Joshua Watson & Co., Ltd., Carlow	20	—
Messrs. Beamish & Crawford, Ltd., Cork	10	—
Messrs. Cairnes, Ltd., Drogheda	15	—
Messrs. E. Smithwick & Sons, Ltd., Kilkenny ..	7	—
Messrs. R. Perry & Sons, Rathdowney	8	—
Messrs. J. H. Bennett, Ltd., Ballinacurra, Co. Cork ..	10	—
Messrs. Latchford & Sons, Tralee	6	8
Total ..	402	8

In addition to the above, the following quantities of Seed Barley were also distributed :—

D.S.K. Binder.	*Brls.*	*Sts.*
To the Agricultural School, Athenry, Co. Galway ..	6	15
July Six-Rowed.		
To the Agricultural School, Athenry, Co. Galway ..	7	12

All seed sown at the Ballinacurra Cereal Station and all seed distributed therefrom were treated with Agrosan powder.

INSPECTION OF GROWING CROPS FOR SEED PURPOSES.

In order that those who co-operate in the Scheme for the Distribution of Pedigree Spratt-Archer seed might have information regarding the suitability of the produce for seed purposes the Department arranged to have the crops which were grown for this purpose inspected by the Agricultural Instructors before harvest. For inspection purposes the crops were divided into three classes : (1) Crops grown from seed obtained from Ballinacurra in 1940 ; (2) Crops grown from seed which was the produce of seed obtained from Ballinacurra in 1939 and (3) Crops grown from commercial seed of Spratt-Archer 37 No. 3. As regards (3), inspections were only made in those cases where the Maltsters concerned were of opinion that they would not have sufficient seed otherwise and so required inspections made of the most promising crops grown from commercial stocks.

A total of 4,955½ statute acres was inspected, of which 4,401⅝ acres were reported as likely to produce grain suitable for seed purposes if properly harvested. Of the 623½ acres inspected under category (1) none was rejected.

In category (2) 2,936 acres were inspected and 413⅝ acres or 14.09 per cent. were rejected. The rejections were chiefly due to other barleys having been sown in the same field, poor crops, smut and the presence of an undue amount of oats and wheat. Under category (3), 1,396 acres were inspected and 140¼ acres or 10.85 per cent. were rejected for the same causes as in category (2).

From the number of crops rejected it is apparent that some distributors did not take sufficient care in the selection of growers and in having the seed properly treated with a fungicidal dressing before it was despatched to growers. It is desirable that firms co-operating in this scheme should exercise care in selecting growers and in treating the seed with a suitable powder dressing before it is despatched to the growers.

LARGE SCALE BARLEY VARIETY EXPERIMENTS.

These experiments were carried out at ten centres in seven counties, one each in Counties Cork, Tipperary, Kilkenny, Kildare and Louth, two in Offaly and three in Wexford. The seed used for the experiments was the produce of the First Pedigree plots established at the Cereal Station, Ballinacurra, Co. Cork in 1939. The area of the plots throughout was one statute acre, and the seeding was at the rate of 10 stones per statute acre. All the seed was dressed with Agrosan powder at the rate of 8 ozs. per barrel of seed. The four varieties sown at all centres were Spratt-Archer 37 No. 3, Spratt-Archer 37/6 No. 7, Spratt-Archer 37 No. 4 x July Six-Rowed 16/2, and Golden Archer 2.

Sowing conditions were favourable, and all plots were sown by 12th April. At all centres the seed germinated well and at the end of May there was a good braird on all plots. Notwithstanding the unusually dry season very good crops were produced at the majority of the centres.

At several centres the variety Spratt-Archer 37/6 No. 7 which ripened seven to nine days earlier than the other varieties, was much damaged by birds; the plot at the Kilkenny centre suffered most in this respect. All plots were free from lodging. The straw was of average length at most centres.

The names and addresses of the growers, the nature of the soil and sub-soil, the crops which were grown in the two previous years and the dates of sowing and harvesting are set out in Table I.

TABLE I.

Large Scale Barley Variety Experiments, 1940.

Centre	Name and Address of Grower	Description of Soil	Previous Crops	Date of Sowing	Date of Harvesting
1	Wm. Tait, Rostellan, Co. Cork ...	Medium Loam Sub-soil, Shale	1938 Oats 1939 Beet	25/3/40	3/8/40 10/8/40
2	J. Bryan, Dunbell, Kilkenny	Deep Loam Sub-soil, Limestone	1938 Roots 1939 Wheat	8/4/40	16/8/40 29/8/40
3	P. Byrne, Ballygrangans, Wexford ..	Sandy Loam Sub-soil, Gravel	1938 Barley 1939 Beet	30/3/40	1/8/40 7/8/40
4	M. P. Minch, Rockfield, Athy .	Deep Loam Sub-soil, Gravel	1938 Barley 1939 Roots	11/3/40	1/8/40 8/8/40
5	M. Howlett, Ramsgrange, Wexford ...	Stiff Loam Sub-soil Shale	1938 Grass 1939 Grass	27/3/40	14/8/40 20/8/40
6	D. Morris, Tomahurra, Enniscorthy .	Shale Loam Sub-soil Shale	1938 Oats 1939 Roots	2/4/40	10/8/40 17/8/40
7	M. Carroll, Belleen, Nenagh ...	Strong Loam Sub-soil, Limestone	1938 Wheat 1939 Roots	6/4/40	24/8/40 28/8/40
8	W. Watkins, Fortal, Birr ..	Light Loam Sub-soil, Limestone	1938 Oats 1939 Roots	5/4/40	14/8/40 29/8/40
9	D. O'Brien, Ballinamore, Tullamore .	Gravelly Loam Sub-soil, Limestone	1938 Wheat 1939 Roots	4/4/40	14/8/40 23/8/40
10	Mrs. Segrave, Dunany, Dunleer ..	Strong Loam Sub-soil, Gravel	1938 Wheat 1939 Roots	12/4/40	30/8/40 2/9/40

In Table II are set out the weights of grain per statute acre, the commercial value of the grain as determined by independent valuers, and the total value of the grain, including the screenings, which were valued at 6d. per stone throughout.

The results set out in Table II show that Spratt-Archer 37 No. 3 gave the highest yield at eight centres, Golden Archer 2 being superior at the Tipperary and Kilkenny centres. Spratt-Archer 37/6 No. 7, although it suffered most from damage by birds, was superior in yield to Spratt-Archer 37 No. 4 x July Six-Rowed 16/2. The latter variety gave the higher yield at only four of the ten centres.

TABLE II.

Large Scale Barley Variety Experiments, 1940. Yield and Value of Grain per Statute Acre.

CENTRE	SPRATT-ARCHER 37 No 3				GOLDEN ARCHER 2				SPRATT-ARCHER 37 No. 4 x JULY SIX-ROWED 16 2				SPRATT-ARCHER 37/6 No. 7			
	Yield of				Yield of				Yield of				Yield of			
	Dressed Grain	Screenings	Value per Barrel	*Total Value including Screenings	Dressed Grain	Screenings	Value per Barrel	*Total Value including Screenings	Dressed Grain	Screenings	Value per Barrel	*Total Value including Screenings	Dressed Grain	Screenings	Value per Barrel	*Total Value including Screenings
	brls. sts	sts	s. d	£ s d	brls sts	sts.	s d	£ s. d	brls sts	sts	s d	£ s. d.	brls sts	sts	s. d.	£ s. d.
Cork: Wm. Tait	14 7	2	30 4	21 18 11	13 13	2	30 2	20 17 8	13 7	3.5	29 11	20 3 9	12 14	4.	30 3	19 11 6
Tipperary: M. Carroll	14 3	1.	30 2	21 8 6	14 7	1.5	30 0	21 13 10	12 0	2.0	29 8	17 17 0	13 14	2.5	30 2	20 19 9
Offaly: W. Watkins	8 14	2.5	30 0	13 7 6	7 1	2.5	30 0	10 13 1	7 12	2.0	29 4	11 8 4	7 13	2.0	30 1	11 16 0
D. O'Brien	13 11	1.5	30 0	20 11 4	13 6	2.5	29 10	20 0 3	11 6	2.5	29 7	16 17 9	11 14	2.5	30 0	17 17 6
Kildare: M. P. Minch	12 4	2.5	30 3	18 11 9	12 0	2.0	30 3	18 4 0	11 4	3.0	29 9	16 16 2	10 2	2.5	29 11	15 4 1
Kilkenny J. Bryan	7 0	3.5	30 2	10 12 11	7 13	5.0	30 1	11 17 6	6 5	3.0	29 8	9 8 9	3 13	4.0	30 1	5 16 10
Wexford M. Howlett	11 9	2.5	30 0	17 8 1	11 3	3.5	30 3	17 0 2	10 0	2.0	29 6	14 16 0	11 8	2.0	29 11	17 5 0
P. Byrne	12 1	1.5	30 4	18 6 8	11 8	1.0	30 1	17 6 5	11 3	1.5	29 9	16 13 7	11 14	1.0	30 0	17 16 9
D. Morris	12 0	1.5	30 1	18 1 9	10 11	1.5	29 11	16 0 5	10 12	1.5	29 8	15 19 8	9 9	2.0	29 11	14 7 0
Louth: Mrs. Segrave	13 0	3.0	30 3	19 14 9	11 10	1.5	30 2	17 11 5	11 2	3.0	29 7	16 10 7	12 2	2.0	29 11	18 3 9
TOTAL	119 1	21.5	—	180 2 2	113 8	23.0	—	171 4 9	105 3	24.0	—	156 11 7	105 7	24.5	—	158 18 2
AVERAGE	11 14	2.0	30 2	18 0 3	11 5	2.0	30 1	17 2 6	10 8	2.0	29 8	15 13 2	10 9	2.0	30 0	15 17 10

*Screenings valued at 6 pence per stone.

TABLE III.

Large Scale Variety Experiment, 1940. Analysis of Produce.

GROWER	SPRATT-ARCHER 37 No 3				SPRATT-ARCHER 37 6 No 7				GOLDEN ARCHER 2				SPRATT-ARCHER 37 No. 4 x JULY SIX-ROWED 16/2			
			On Dry Matter				On Dry Matter				On Dry Matter				On Dry Matter	
	Bushel Weight lb	Moisture %	Weight of 1,000 Corns grms	Nitrogen %	Bushel Weight lb	Moisture %	Weight of 1,000 Corns grms	Nitrogen %	Bushel Weight lb	Moisture %	Weight of 1,000 Corns grms.	Nitrogen %	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms	Nitrogen %
Wm Tait	55.2	16.1	37.6	1.27	55.4	15.7	38.2	1.29	55.8	16.0	38.4	1.29	55.8	15.9	37.2	1.23
Ml. Howlett	56.7	16.8	42.3	1.52	56.6	15.8	42.2	1.64	56.8	16.5	42.4	1.48	55.5	16.4	40.8	1.68
P Byrne	56.7	16.8	38.8	1.32	56.8	16.6	39.8	1.33	57.0	16.7	39.2	1.28	56.0	16.8	39.0	1.35
D. Morris	56.3	16.3	41.4	1.73	56.3	15.8	41.7	1.70	56.1	17.3	42.6	1.61	55.2	16.3	41.1	1.67
J Bryan	56.4	17.0	37.9	1.22	56.6	16.4	39.6	1.35	53.5	21.0	37.9	1.27	55.0	18.0	36.8	1.27
M. P Minch	55.1	16.5	39.3	1.30	54.6	15.8	39.5	1.36	54.8	17.1	41.1	1.32	54.7	16.3	40.6	1.39
D O'Brien	56.3	18.5	42.5	1.60	56.7	16.4	41.7	1.58	56.1	18.6	44.1	1.74	55.1	18.4	43.0	1.65
W. Watkins	54.0	18.7	39.2	1.29	55.0	16.7	41.2	1.38	54.6	18.2	40.0	1.36	52.9	18.6	40.1	1.37
M Carroll	56.2	18.2	44.8	1.40	56.7	17.1	45.2	1.50	55.9	18.7	44.6	1.40	54.7	17.9	42.9	1.53
Mrs Segrave	57.5	17.0	43.5	1.46	58.0	16.5	44.9	1.49	55.9	19.2	44.1	1.47	55.6	17.4	40.5	1.50
Total	560.4	171.9	407.3	14.11	562.7	162.8	416.8	14.62	556.5	179.3	414.4	14.22	550.5	172.0	402.0	14.64
Average	56.0	17.2	40.7	1.41	56.3	16.3	41.7	1.46	55.7	17.9	41.4	1.42	55.1	17.2	40.2	1.46

The results of the analyses of the produce for the various plots which are set out in Table III show that Spratt-Archer 37 No. 8 again had a lower percentage of nitrogen than any of the other varieties under trial, thus indicating its continued superiority as a malting barley. The average results set out in this Table also show that the moisture content was unusually low while the bushel weight and 1,000 corn weight were much higher than normal.

HALF DRILL STRIP EXPERIMENT.

In this experiment, which was carried out on the farm of Messrs. John H. Bennett, Ltd., the produce of the 1939 Field Plot of Spratt-Archer 37 No. 8 was tested against the produce of the Second Pedigree Plot of the same variety, the object being to ascertain if the younger generation was maintaining the desirable qualities of the older generation. The trial consisted of twenty-two strips of each generation under test, a strip being half the width of the sowing machine.

To ensure even sowing, the seed in each half of the corn drill was changed over for the sowing of the second half of the experiment.

The results which are set out in Table IV show that the returns from the two generations are very similar.

TABLE IV.

Half Drill Strip Experiment, 1940.

Field Plot	st.	lb.	Second Pedigree	st.	lb.
a	3	2.5	B	3	0
C	2	13	b	2	12
c	2	11	D	2	11.5
E	2	11.5	d	2	13.5
e	2	10.5	F	2	9.5
G	2	9.5	f	2	9
g	2	12	H	2	8
I	2	5.6	h	2	9.5
i	2	5.5	J	2	9
K	2	9	j	2	8
k	2	13	L	2	11
M	2	11.5	l	2	10
m	2	10	N	2	9
P	2	5	n	2	8.5
p	2	5.5	Q	2	8
R	2	10	q	2	9
r	2	12	S	2	9.5
T	2	9.5	s	2	9.5
t	2	11.5	V	2	10
W	2	7.5	v	2	8
w	2	11.5	X	2	6
Y	2	10	x	2	5.5
TOTAL	59	12	TOTAL	58	12
AVERAGE	2	10.09	AVERAGE	2	9.45
Average Moisture	13	6	Average Moisture %	13.5	
Average Nitrogen %	1.27		Average Nitrogen %	1.27	
Average Weight of 1,000 corns (grms.)	38.9		Average Weight of 1,000 Corns (grms.)	39.0	
Relative Malting Quality	100.0		Relative Malting Quality	100.1	

SMALL SCALE QUANTITATIVE EXPERIMENT, 1940.

This experiment was conducted in the Cage at the Cereal Station. Eight varieties were included and were sown in a series of randomised blocks. There were fourteen replications of each variety.

The varieties included were : Spratt-Archer 37 No. 3, Kenia, Maja, D.S.K. Binder, Hybrid, 4 B. 1 x Golden Archer 1, Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2 (Bulk), Spratt-Archer 37 No. 3 H. 9 x Hybrid 4 B. 1 (Bulk), July Six-Rowed.

The results are set out in Table V.

Last year the standard variety Spratt-Archer 37 No. 3 gave the best yield. This year it is the lowest of all, although it is second highest in quality. The varieties Kenia and Maja gave the highest yields, but their respective malting quality was low.

TABLE V.

Small Scale Quantitative Experiment, 1940.

Average of Fifteen Plots.

Variety	Weight of Ears	Weight of Grain	Nitrogen %	Weight of 1,000 Corns	Relative Malting Quality
Maja	209.31	170.38	1.37	39.1	96.8
Kenia	212.34	170.24	1.47	41.1	98.8
Hybrid 4 B 1. x Golden Archer 1	187.75	149.48	1.51	41.3	99.8
Spratt-Archer 37 No. 3 x Hybrid 4 B.1 (Bulk)	172.21	134.32	1.42	40.3	99.4
Spratt Archer 37 No. 3 H 9 x Golden Archer 2 (Bulk)	184.52	133.60	1.37	40.3	101.4
D. S. K. Binder	178.25	132.96	1.52	40.6	98.1
July Six-Rowed	158.40	126.04	1.58	29.6	97.3
Spratt-Archer 37 No. 3	173.50	125.2	1.39	39.1	100.0

OATS.

Pure Line :—A single plant selection and a garden plot of Black Tartary oats were grown at the Cereal Station in order to retain a pure line stock of this variety.

DEPARTMENT'S EXTENSION PLOTS.

In order to have available stocks of pedigree seed oats for merchants and others interested in the distribution of pedigree seed, stocks of Victory II and Ardri oats were grown under agreement with selected farmers in the neighbourhood of Ballinacurra. These stocks were grown, harvested, and threshed under the Department's supervision. The produce was kiln-dried, cleaned and made available for distribution in the spring of 1941.

The following are the names and addresses of growers, together with the acreage and amount of seed sown :—

VICTORY II.	*Acres*	*Brls.*	*Sts.*
J. O'Reilly, Ballinabointra, Carrigtwohill	3	3	6
R. Scanlon, Geragh, Ballinacurra, Co. Cork	4	4	8
T. Twomey, Ballintubber, Carrigtwohill, Co. Cork ..	5	5	10
M. Kelleher, Geragh, Ballinacurra, Co. Cork	6	6	12
J. J. Smyth, Violet Hill, Cloyne, Co. Cork . ..	11½	13	2
Wm. Tait, Hermitage, Rostellan, Co. Cork	3½	3	6
Total ..	33	37	2

ARDRI.	*Acres*	*Brls.*	*Sts.*
Wm. Tait, Buckstown, Rostellan, Co. Cork	7	8	—
R. Barry, Broomfield, Midleton, Co. Cork	8	9	2
J. Barter, Inchiquin, Killeagh, Co. Cork	11	12	8
J. Hegarty, Ballinbeg, Rostellan, Co. Cork	6	6	12
P. O'Keeffe, Ardra, Rostellan, Co. Cork	5	5	10
S. Northridge, Ballymacsliney, Midleton, Co. Cork ..	6	6	12
Total ..	43	49	2

SCHEME FOR THE DISTRIBUTION OF PEDIGREE STOCKS OF SEED OATS.

Under the Department's Scheme nucleus stocks of pedigree Victory II and Ardri, which were propagated in the Ballinacurra district in 1939, were distributed to Seed Merchants and others in the spring of 1940.

These pedigree stocks were supplied to merchants on condition that they would undertake to have the seed grown by reliable farmers, to purchase the produce, if suitable, and to retain it for seed purposes. In order to facilitate merchants, the Department arranged for the inspection by the Agricultural Instructors of the growing crops. Reports received at the end of the 1940 season indicated that in practically all cases the crops grown from the pedigree seed were likely to produce grain suitable for seed purposes. Consequently merchants who participated in this Scheme and who took sufficient care in the selection of growers and in the subsequent handling of the produce, have large stocks of high-class home-grown seed oats available for sowing in the spring of 1941.

Under the above Scheme, foundation stocks of pedigree seed oats were supplied to the following in 1940 :—

VICTORY II.

The Superintendent, Agricultural School, Athenry.
The Superintendent, Agricultural School, Clonakilty.
The Superintendent, Agricultural School, Ballyhaise.
Messrs. Minch, Norton & Co., Ltd., Bagenalstown.
Lisavaird Co-op. Creamery, Ltd., Clonakilty, Co. Cork.
Messrs. H. Good, Ltd., Kinsale, Co. Cork.
Messrs. J. Callaghan & Sons, Glanworth, Co. Cork.
Messrs. McKenzies & Sons, Ltd., Cork.
Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
Messrs. Latchford & Sons, Tralee.
Messrs. M. Rowan & Co., Dublin.
Messrs. Wm. Drummond & Sons, Dawson Street, Dublin.
Messrs. F. A. Waller & Co., Ltd., Banagher.
The Birr Maltings, Ltd., Birr, Offaly.
Messrs. D. & E. Williams, Ltd., Tullamore, Offaly.
Messrs. N. Hardy & Co., Ltd., Dundalk.
Messrs. O'Hara & Ryan, Ltd., Nenagh, Co. Tipperary.
The Bride Valley Stores, Tallow, Co. Waterford.
Dungarvan Co-op. Creamery, Ltd., Dungarvan, Co. Waterford.
Mr. D. Daly, 4 Earl Street, Mullingar.
Enniscorthy Co-op. Agricultural Society, Ltd., Enniscorthy.

Messrs. Hopkins & Sons, Ltd., Wicklow.
Messrs. Suttons & Sons, Cork.
Messrs. John H. Bennett, Ltd., Ballinacurra, Co. Cork.
Irish Sugar Beet Growers' Association, Ltd., Carlow.

ARDRI.

The Superintendent, Agricultural School, Athenry.
The Superintendent, Agricultural School, Clonakilty.
Mr. Ml. Hand, Berries, Athlone.
Mr. A. Finerty, Convent Farm, Roscommon.
Mr. J. Mee, Coolderny, Athleague, Roscommon.
Mr. J. Mannion, Ballyline, Curraghboy, Athlone.
Mr. E. C. Byrne, Sallowgrove, Curraghboy, Athlone.
Messrs. Minch, Norton & Co., Ltd., Bagenalstown.
Messrs. Graigue Cullen, Corn and Coal Co., Ltd., Carlow.
Messrs. E. McLysaght's Nurseries, Mallow, Co. Cork.
Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
Messrs. M. Rowan & Co., Ltd., Dublin.
Messrs. T. McKenzie & Sons, Ltd., Dublin.
Messrs. Latchford & Sons, Tralee, Co. Kerry.
Messrs. N. Hardy & Co., Ltd., Dundalk.
Messrs. P. J. Healy, Athleague, Roscommon.
Mr. D. Daly, 4 Earl Street, Mullingar.
Enniscorthy Co-op. Agricultural Society, Ltd., Enniscorthy.
Mr. G. Byrne, Bree, Ballyhogue, Wexford.
Shelbourne Co-op. Agricultural Society, Campile, Co. Wexford.
Mr. S. Geraty, Carnew, Co. Wicklow.
Mr. J. J. Furlong, Littlegraigue, Duncormick, Co. Wexford.
Messrs. D. H. Haskins & Sons, Wicklow.
Messrs. J. H. Roche & Sons, 46, Upper William Street, Limerick.
Messrs. J. H. Bennett, Ltd., Ballinacurra, Co. Cork.
Irish Sugar Beet Growers' Association, Ltd., Carlow.

The Albert Agricultural College co-operated with the Department in the working of the foregoing Scheme, and distributed stocks to the following :—

ARDRI.

Messrs. John H. Bennett, Ltd., Ballinacurra, Co. Cork.
Major E. M. Connolly, Castletown, Celbridge, Co. Kildare.
Mr. John Ennis, Naul Park, Naul, Co. Dublin.
Mr. D. McGranaghan, Nobber, Co. Meath.
Mr. T. Caffrey, Coolock House, Coolock, Co. Dublin.

SONAS MARVELLOUS.

The Farm Manager, Munster Institute, Cork.

GLASNEVIN SONAS.

The President, All Hallows College, Drumcondra, Dublin.

GLASNEVIN SUCCESS.

The President, All Hallows College, Drumcondra, Dublin.
Mr. T. Caffrey, Coolock House, Coolock, Co. Dublin.

WHEAT.

Red Marvel.—A stock of pedigree seed of this variety was obtained from the Albert Agricultural College, and was grown on the farm of Messrs. J. H. Bennett, Ltd., Ramhill North Farm, Ballinacurra, the object being to provide stocks of suitable seed for districts where spring wheats are grown.

FRUIT CROP REPORT, 1940

WEATHER CONDITIONS

The early months of 1940 will be remembered as the severest experienced for a great number of years. Cold, unsettled weather was general during January and the heavy frost which occurred between the 12th and 23rd of the month caused severe injury to many plants which usually survive successfully the normal winters in this country. The lowest temperatures were recorded on 17th and 18th January when 21 degrees of frost were registered. The wintry weather continued into February when snow, heavy rain and flooding were general.

An improvement occurred in March when there was a number of fine days but frost was recorded on eleven nights. The weather in April was variable with showers and fine periods alternating in the early part of the month. Nine degrees of frost were recorded on the 17th April and although apple blossoms were not then in an advanced state of development, severe damage was done. Towards the end of the month the weather was milder.

For the most part the weather in May was dry, mild and free from frost. Bright, warm, dry days followed in June with temperatures above normal. The result was that the development of bush and soft fruits was retarded, and the crops were consequently on the light side. Apples appeared to suffer severely from the continued drought and it was possibly one of the factors which contributed to the abnormally severe " June drop " which occurred amongst most varieties.

Rain fell at various parts of the country in July and although August generally was bright, warm and dry over the greater part of the country, unsettled weather was recorded in the N.W.

Showery weather occurred towards the middle of September and a severe gale about the 13th of the month caused serious loss in apple orchards. Windfall fruit glutted the markets for a time and resulted in poor prices all round. The development of all varieties of apples was hastened by the dry summer and harvesting was, therefore, necessary much before the normal date.

From October onward the weather was characterised by dry, wet and stormy periods alternating and a comparative absence of severe frost.

Table showing in a general way the nature of the yields obtained in each County.

County	Gooseberries	Black Currants	Strawberries	Raspberries	Apples	Plums and Damsons	Other Fruits
Carlow	Below average	Below average	Poor	Very poor	Below average	Fair to good	Average
Cavan	Good	Fair to good	Very good	Poor	Below average	Very good	Good
Clare	Good	Very good	Good	Fair	Below average	Very light to average	Good
Cork	Good to very good	Light to average	Good	Average to good	Below average	Light to good	Good
Donegal	Average	Good	Above average	Fair	Average	Good	Average
Dublin	Light to average	Average	Below average	Fair to average	Average	Fair to good	Average to good
Galway	Very good	Good	Fair	Good	Light to fair	Fair	Good
Kerry	Good	Average	Good	Good	Fair to below average	Fair	Average
Kildare	Very good	Fair	Light to average	Very good	Light to average	Good	Very good
Kilkenny	Fair	Below average	Good	Good	Below average	Light	Good
Laoighis	Good	Fair to average	Average	Good	Average	Good	Good
Leitrim	Very good	Below average	Fair	Fair to good	Below average	Fair to good	—
Limerick	Fair to good	Below average	Light to average	Poor to average	Light to average	Light to good	Very good
Longford	Very good	Very light	Above average	Below average	Light	Very good	—
Louth	Good	Below average	Average	Good	Below average	Fair to average	Good
Mayo	Fair to good	Light	Light	Very good	Light to average	Fair to good	Average
Meath	Good	Poor	Very good	Good	Light to good	Good	-
Monaghan	Below average	Below average	Very good	—	Below average	Light to good	--
Offaly	Very good	Fair	Fair	Poor	Average	Very good	--
Roscommon	Good	Light to good	Very good	Fair	Below average	Good	
Sligo	Average	Below average	Below average	Below average	Below average		-
Tipperary	Fair to average	Fair to good	Good to average	Good to average	Average to below average	Average	Normal
Waterford	Fair to good	Below average	Very good to average	Very good to average	Below average	Average	Good to average
Westmeath	—	Below average	Very poor	Fair	Good	Very good	—
Wexford	Fair to very good	Fair	Fair to very good	Light to average	Below average	Poor	Good
Wicklow	Very good	Very good	Very good	Below average	Average	Very good	Good

DISEASES AND PESTS

Many of the troubles experienced during the year by apple growers were physiological rather than pathological in nature.

Bitter Pit, Post-Spray Russeting, Storage Scald and Breakdown were more than normally prevalent.

Of the fungoid diseases Apple Blossom Wilt was abnormally severe, while Scab, though prevalent everywhere, was serious only in neglected orchards.

Aphis caused some damage and attacks of Capsid Bug were reported from several counties.

American Gooseberry Mildew, Cluster Cup and Gooseberry Sawfly were reported from many areas. Plums were attacked by Silver Leaf Disease, Aphis, and Die-back Virus and "Red Plant" disease were reported by strawberry growers in the eastern counties.

MARKET PRICES

Strawberries

Indoor Forced	2/ to 3/6 per lb.
Outdoor Grown	10d.- -1/8 per lb.
Jam Fruit	49/ to 53/- per cwt.

Gooseberries

Green	2/6 to 4/- per 12-lb. chip.
Ripe	3/6 to 6/ per 12-lb. chip.
Jam Fruit	16/- to 18/- per cwt.

Raspberries

In Punnets	8d. to 1/4 per lb.
Jam Fruit	42/- per cwt.

Black Currants

In Punnets	7d. to 10½d. lb.
Jam Fruit	56/- per cwt.

Plums and Damsons

Victoria Plums	8/- to 14/- per 12-lb. chip.
Horse Plums	5/- to 6/- per 12-lb. chip.
Damsons	5/- to 6/- per 12-lb. chip.

APPLES

With a view to remedying the unsatisfactory position regarding the marketing of home-grown apples an Apple Marketing Scheme, particulars of which have been given in a previous issue of this Journal (Vol. XXXVII. No. 2) was put into operation during the year. Following on the introduction of the Scheme central packing stations were established at a number of centres in the principal apple producing areas. A considerable proportion of the crop grown in the districts adjoining these packing stations was marketed by them and, in addition, a number of individual growers throughout the country participated in the Scheme. The result was that a creditable improvement in packing methods was achieved and satisfactory prices were realised for both dessert and culinary varieties marketed in accordance with the provisions of the Apple Marketing Scheme.

DESSERT VARIETIES

Per Bushel box	15/- to 25/

CULINARY VARIETIES

Per Bushel box .	10/- to 15/, with highly coloured Newton Wonder reaching 23/
Per Five Stone box .	10/- to 18/

APPLES FOR MANUFACTURING PURPOSES

Jam Fruit	£3 10s.—£4 per ton.
Cider Fruit	£3 10s. per ton.
Fruit for canning purposes . ..	£10 to £14 per ton.

NATIONAL EGG-LAYING TEST, 1939-40

NATIONAL EGG-LAYING TEST, 1939-40.

The Twenty-eighth Egg-Laying Test, conducted by the Department of Agriculture, was held at the Munster Institute, Cork, during a period of 46 weeks, beginning on the 1st October, 1939, and ending on 17th August, 1940. A total of 112 pens, each consisting of six pullets, having fulfilled the required conditions, was accepted and arranged in Sections as follows :—

Section I.—White Wyandotte	17 pens
Section II.—White Wyandotte (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1939)	28 ,,
Section III.—Rhode Island Red	15 ,,
Section IV.—Rhode Island Red (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1939)	18 ,,
Section V.—Any non-sitting breed	17 ,,
Section VI.—Any other general purpose breed	17 ,,

Station holders were, as heretofore, allowed to enter a second pen in one of the open sections on payment of the requisite entry fee.

As in the nine previous tests, only pullets which were certified by the Veterinary College, Ballsbridge, Dublin, as being non-reactors to the agglutination test for Bacillary White Diarrhœa, were accepted.

Minimum Weights. The clause introduced in the regulations in 1928-29, whereby birds were required to be of specific minimum weights on arrival, was enforced. The following were the prescribed minimum weights for the respective breeds :—

All non-sitting breeds	$3\frac{1}{2}$ lb.
White Wyandotte	$4\frac{1}{2}$ lb.
Rhode Island Red	$4\frac{1}{2}$ lb.
Plymouth Rocks	5 lb.
Sussex	$5\frac{1}{2}$ lb.
Any other sitting breed	$5\frac{1}{2}$ lb.

Eggs were graded as follows :—

Egg Grades.

Special Grade.—$2\frac{1}{8}$ oz. and over for the first eight weeks (1st October to 25th November, inclusive), $2\frac{1}{4}$ oz. and over throughout the remainder of the test.

First Grade.—A minimum of $1\frac{15}{16}$ oz. for the first eight weeks, a minimum of 2 oz. during the remainder of the test.

Second Grade.—Eggs which were not more than $\frac{1}{4}$ oz. less than the minimum weight prescribed for first grade eggs in the same period. Eggs which weighed less than the minimum weight prescribed for second grade eggs were recorded separately, but were not included in the score total on which awards were based.

Egg Yields.

Making no allowance for deaths, the average number of eggs per pullet was 180.4. The average number of eggs per pullet for which a record for the full 46-week period was available was 190.1 (see Table II.) These averages represent a decrease as compared with the corresponding figures in the previous Test, in which the averages were 188.3 and 196.9 respectively. The average production per pullet during each of the twelve periods for each breed is given in Table III. One White Wyandotte pullet did not lay during the Test.

Egg Size

Twenty-three pens were disqualified for producing more than 20 per cent. of second grade eggs. This figure was nineteen for the previous Test.

Egg Weights

The average weight of egg for each of the competing breeds is listed in Table IV. The average weight per dozen eggs for all breeds was 26.1 oz., and only two pens were disqualified for failing to reach the standard weight of 24 oz. per dozen. The figures for the previous Test were 26.2 oz. and one respectively. In Table V are given the number and percentage of the different grades of eggs for each breed in respect of pullets which completed the full 46-week period.

Eggs under the Prescribed Weight for Second Grade

The number of ungraded eggs laid by pullets of each breed which completed the full 46-week period is given in Table VII. The number of such pullets of all breeds which laid ungraded eggs was 150 and the number of ungraded eggs produced by them was 527. The corresponding figures for the previous Test were 140 and 498 respectively.

Copper Rings

Of the 611 birds which completed the full 46-week period, 183 or 30.0 per cent. laid 200 or more first grade eggs and not more than 20 per cent. second grade (see Table VIII). Of these, 139 were leg-banded with numbered sealed copper rings (see Table IX) as compared with 200 in the previous Test. Copper rings were withheld from the following 44 birds which were not suitable for breeding purposes :—

(*a*) Breed Standard Defects :—

16 White Wyandotte.
9 Rhode Island Red.
5 White Leghorn.
2 Light Sussex.
1 Buff Rock.

(*b*) Under Prescribed Weight at Conclusion of Test :—

4 White Wyandotte.
1 Light Sussex.
1 Buff Rock.
1 Barred Rock.

(*c*) Consistent Producers of Defective Eggs :—

2 Light Sussex.
1 Rhode Island Red.

(*d*) Constitutional Defects :—

1 White Leghorn.

The rings were distributed as follows :—

1 pen	.. ..	Five copper rings.			
5 pens	.. ..	Four	,,	,,	each
12 ,,	.. ..	Three	,,	,,	,,
24 ,,	.. ..	Two	,,	,,	,,
30 ,,	.. ..	One copper ring			,,

Particulars of eggs produced by the birds which were awarded copper rings are given in Table IX.

Certificates of Merit.

A total of 244 birds, representing 39.9 per cent. of the number surviving the full period of the Test, qualified for certificates. Of these, 139 birds (22.7 per cent.) were awarded Special Certificates (see Table IX), and 105 birds (17.2 per cent.) Certificates (see Table X).

Certificates were not awarded for pullets which produced over 20 per cent. of second grade eggs, nor for those showing breed or other defects.

Mortality

During the course of the Test 61 birds died, representing a mortality of 9.1 per cent., and an increase of 1.9 per cent. as compared with the previous Test. The deaths were confined to a small proportion of the pens, those occurring in four being accountable for almost 25 per cent. of the total. The distribution of total deaths was as follows :—

1 pen	5 deaths	
1 ,,	4 ,,	
2 pens	3 ,,	each.
6 ,,	2 ,,	,,
34 ,,	1 death	,,

In the remaining 63 pens all birds completed the Test. Table XII gives particulars of the pullets that died and the cause of death in each case. Analysis of the causes of death shows that 26.2 per cent. of the mortality was due to Peritonitis and Oviductitis, 16.4 per cent. to Gout, and 9.8 per cent. to Tumours of different kinds. Worm infestation was responsible for 8.2 per cent. and Tuberculosis for less than 5 per cent. of the total mortality.

B.W.D. Test.

All birds alive at the conclusion of the Test were submitted to the Agglutination Test for Bacillary White Diarrhoea, and there were two reactors.

Feeding.

The system of feeding was similar to that employed during previous Tests. The birds were fed three times daily. The morning feed consisted of half the grain ration given as scratch feed in the litter, the mid-day feed of wet mash, and the evening feed of the remainder of the grain ration fed in troughs. Dry mash was fed *ad lib.* The mash, both dry and wet, was made up to the following formula :—

4 parts	by weight	Pollard.
8 ,,	,,	Bran.
2 ,,	,,	Maize Meal.
1 part	,,	Finely Ground Oats.
1 ,,	,,	Fish Meal.

The grain mixture consisted of equal parts of wheat, oats and cracked maize. Vegetables, such as cabbage, kale, turnips and mangels,

were fed during certain seasons, and grit and shell were allowed *ad lib.* The following quantities of foods were consumed :—

Mixed Meals	42,728 lb.
Grain	25,032 „
Grit and Shell	3,248 „

NOTES ON COMPETING BREEDS.

WHITE WYANDOTTE.

Sections I and II

Very many fine birds were included in the 35 pens of this breed, but neither the quality nor the productive capacity of the birds generally were up to the standard of recent Tests. Individual birds showing breed defects were to be found in some pens, and the size and development of a number of birds were not satisfactory. Production was slightly lower, but egg size and quality were well maintained. Mortality in the breed was higher than in recent Tests.

RHODE ISLAND RED.

Sections III and IV

The thirty-three pens were composed of birds of excellent quality. With few exceptions the birds of this breed were satisfactory in type, colour, and development. Birds of poor colour were however included in a few pens, and individual birds showing other breed defects were also included. The average production of over 200 eggs during the period of the Test for all surviving birds shows that production was very satisfactory. Egg size and quality were also of desirable standard and the mortality in the breed was extremely low. The leading pen (No. 61, entered by Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford) in Section III also was the best pen in the Test, and won the silver cup. During the period of the Test this pen put up the excellent score of 1,413 eggs of which only 82 were second grade. Furthermore the birds were excellent specimens of the breed.

ANY NON-SITTING BREED.

Section V

The majority of the seventeen pens of White Leghorns were well developed birds of good quality. A number of undersized birds and birds showing breed defects were, however, included. Production was not up to the level of recent Tests, but mortality was very low.

ANY OTHER GENERAL PURPOSE BREED.

Section VI

This section was composed of twelve pens of Light Sussex, three of Buff Plymouth Rock, and two of Barred Plymouth Rock. The Light Sussex birds were generally good specimens of the breed, but many of them were underdeveloped and backward on

arrival at the Test. The Buff and Barred Plymouth Rock pens were mostly composed of well-grown birds of good type. The production of both the Light Sussex and Buff Plymouth Rock birds did not reach the level of these breeds in previous Tests. Egg size and quality were satisfactory.

CONCLUSION.

From the results of the Test it is evident that many poultry breeders in this country are producing laying stock of the highest quality.

In addition to its function in comparing the stock from different breeders under uniform conditions, the Test provides breeders with individual records of the birds entered, while the awards indicate which birds are suitable for breeding purposes in subsequent years. For this reason it is very desirable that the pullets sent to the Test should be well developed, typical of their breed, and free from breed defects and disqualifications. Competitors should, therefore, devote particular attention to these points when selecting pullets for the Test.

Table I.

The following Table shows the number of pullets competing, the number of eggs laid, cost of food, return for eggs and gross profit for each of the twenty-eight tests held since 1912/13:—

Forty-eight weeks ended	No. of Pullets	No. of Eggs Laid	Average Number per Bird	Average Value per Bird	Cost of Food per Bird	Average Price of Eggs per doz.	Return per Bird over Cost of Food
				s. d.	s. d.	d.	s. d.
31st Aug., 1913	818	38,199	120.1	11 2.8	5 8	13.1	5 6.8
„ 1914	282	39,216	139.0	13 3.6	5 8.3	13.8	7 7.8
„ 1915	264	39,764	150.6	17 6	7 0.5	16.8	10 5.5
„ 1916	294	49,830	169.5	23 0.5	8 11.8	19.6	14 0.7
„ 1917	210	36,660	174.6	32 7.2	13 10.7	26.9	18 8.5
„ 1918	210	36,106	171.9	47 4	16 6	39.7	30 10.1
„ 1919	306	55,124	180.0	53 3.4	20 0	42.6	33 3.4
„ 1920	354	65,840	186.0	53 9	19 3.9	41.6	34 5.2
„ 1921	288	51,584	179.0	40 9.5	18 7.3	32.8	22 2.2
9th Sept., 1922	342	63,518	185.7	33 8.8	11 10	26.2	21 10.8
10th „ 1923	198	38,519	194.5	27 11.5	12 1	20.8	15 10.5
15th „ 1924	342	61,144	178.8	26 6.5	11 1.5	21.4	15 5.0
15th „ 1925	348	63 755	183.2	27 4.9	10 5.2	22.6	16 11.7
15th „ 1926	342	65,137	190.4	28 6.1	10 7.8	21.5	17 10.3
16th „ 1927	492	93,912	190.9	26 10.7	9 3.6	20.3	17 7.1
16th „ 1928	510	95,226	186.7	24 10.9	10 8	19.2	14 2.9
16th „ 1929	540	101,820	188.6	28 8.5	11 0.5	21.9	17 8.0
16th „ 1930	588	100,752	171.3	24 4.2	8 5.8	20.5	15 10.4
16th „ 1931	588	111,180	189.1	24 4	7 3	18.5	17 1.0
15th „ 1932	600	111,986	186.6	21 3.6	6 4.2	16.4	14 11.4
12th „ 1933	606	113,047	186.5	17 11.6	5 1.8	13.9	12 9.8
10th „ 1934	606	112,177	185.1	19 5	5 8.9	15.1	13 8.1
7th „ 1935	702	131,384	187.1	18 3	6 7.7	14.0	11 7.3
3rd „ 1936	702	130,940	186.5	20 7.5	7 3.2	15.9	13 4.3
Forty-six weeks ended							
18th Aug., 1937	708	125,621	177.4	20 10.5	7 7.2	16.9	13 3.3
„ „ 1938	678	126,143	186.1	21 9.9	8 4.6	16 9	13 5.3
„ „ 1939	708	133,306	188.3	23 0.6	8 8.8	17.6	14 3.8
17th „ 1940	672	121,250	180.4	27 6.8	10 10.4	22.0	16 8.4

It should be noted that the figures given in Table I above are based on the total number of pullets competing, no allowance having been made in respect of deaths.

Taking the birds which died during the 1939–40 Test into account only up to the date of death, the average number of pullets for the whole period was 649.0, and the average number of eggs per bird 186.8. On this basis the average egg value per bird was 28s. 6.5d., the cost of food per bird 11s. 3d., and the return per bird over cost of food 17s. 3.5d.

Table II.

Average Egg Yield for each Breed.

Breed	No. of Pullets for full period	No. of eggs laid	Average No. of eggs per pullet	Grade Averages per Pullet		
				Special	First	Second
White Wyandotte ..	236	45,274	191.8	97.5	77.9	16.4
Rhode Island Red ..	187	37,640	201.3	77.7	97.7	25.9
White Leghorn	97	17,445	179.8	78.2	84.4	17.2
Light Sussex	66	11,279	170.9	59.9	86.6	24.4
Buff Rock	14	2,287	163.4	62.4	70.1	30.9
Barred Rock	11	2,246	204.2	33.6	114.2	56.4
All Breeds ..	611	116,171	190.1	82.3	86.4	21.4

Table III.

Average Egg Yield per Pullet during each of the Twelve Periods.

Breed	Number of Pullets for full period	Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Average for full period
White Wyandotte	236	13.9	16.4	17.4	16.9	16.8	18.8	20.4	19.4	17.0	14.3	14.0	6.5	191.8
Rhode Island Red	187	12.6	13.9	16.6	17.4	18.4	20.4	22.8	21.7	19.6	16.2	14.8	6.9	201.3
White Leghorn	97	10.2	13.6	13.8	13.7	15.7	19.3	21.4	20.4	18.3	14.8	12.6	6.0	179.8
Light Sussex	66	14.1	13.7	13.4	14.4	16.4	18.0	18.7	17.1	14.6	11.8	12.6	6.1	170.9
Buff Rock	14	9.2	16.3	15.8	13.6	16.2	18.1	18.1	15.8	18.0	14.3	8.9	4.1	163.4
Barred Rock	11	12.5	15.5	16.5	18.0	18.5	21.1	24.0	22.7	18.7	16.6	13.4	6.7	204.2
All Breeds ...	611	12.8	14.9	16.1	16.2	17.1	19.3	21.1	20.0	17.7	14.7	13.7	6.5	190.1

Table IV.

Average Weight of Egg for each Breed.

Breed	Total Number of Eggs Laid	Total Weight of Eggs	Average Weight of Egg	Average Weight Per Dozen
		lb. oz. dr.	oz. dr.	oz.
White Wyandotte ..	47,826	6,574 15 4	2 3.2	26.4
Rhode Island Red ..	38,874	5,236 5 6	2 2.5	25.9
White Leghorn ..	17,732	2,411 8 10	2 2.8	26.1
Light Sussex	11,834	1,578 15 14	2 2.2	25.6
Buff Rock	2,677	355 15 12	2 2.0	25.5
Barred Rock	2,307	297 9 12	2 1.0	24.8
All Breeds ..	121,250	16,455 6 10	2 2.7	26.1

TABLE V.

Number and Percentage of Special, First, and Second Grade Eggs for each Breed in respect of Pullets which completed the full 46-week Period.

Breed	Eggs Laid			Percentage Distribution		
	Special Grade	First Grade	Second Grade	Special Grade	First Grade	Second Grade
				%	%	%
White Wyandotte ..	23,003	18,390	3,881	50.8	40.6	8.6
Rhode Island Red ..	14,538	18,261	4,841	38.6	48.5	12.9
White Leghorn	7,582	8,192	1,671	43.5	46.9	9.6
Light Sussex	3,954	5,717	1,608	35.0	50.7	14.3
Buff Rock	873	981	433	38.2	42.8	19.0
Barred Rock	870	1,256	620	16.5	55.9	27.6
All Breeds .	50,320	52,797	13,054	43.3	45.5	11.2

TABLE VI.

Average Number of First Grade Eggs per Pullet during the period 1st October to 29th December, inclusive (90 days).

Breed	Number of Pullets	Number of First Grade Eggs	Average Number of First Grade Eggs per Pullet
White Wyandotte	264	10,833	41.0
Rhode Island Red	198	7,120	36.0
White Leghorn	101	2,986	29.6
Light Sussex	71	2,454	34.6
Buff Rock	18	527	29.3
Barred Rock	12	282	23.5
All Breeds	664	24,202	36.4

TABLE VII.

Eggs under the prescribed weight for Second Grade.

BREED	Number of Pullets for full period which laid ungraded eggs	Number of ungraded eggs
White Wyandotte	51	168
Rhode Island Red	41	151
White Leghorn	32	79
Light Sussex	18	113
Buff Rock	5	10
Barred Rock	3	6
All Breeds	150	527

TABLE VIII

Number and Percentage of Pullets of each Breed which laid 200 First Grade Eggs and over, and not more than twenty per cent. Second Grade.

BREED	Number of Pullets for Full Period	Number of Pullets which laid 200 First Grade Eggs and over	Percentage of Pullets which laid 200 First Grade Eggs and over
			%
White Wyandotte	236	86	36.4
Rhode Island Red	187	65	34.8
White Leghorn	97	16	16.5
Light Sussex	66	12	18.2
Buff Rock	14	2	14.3
Barred Rock	11	2	18.2
All Breeds	611	183	30.0

SECTION PRIZES.

Section I.—White Wyandotte.

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Miss B. Quain, Anglesboro, Co. Limerick, *via* Mitchelstown.	£ s. d. 10 2 5	1,299	9	216.5
Second Prize (£7) Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	10 0 8¼	1,291	28	215.2
Third Prize (£5) Mrs. J. R. Boyd, The Rectory, Killaloe, Co. Clare.	9 17 0	1,293	169	215.5
Fourth Prize (£4) Miss M. O'Brien, Moycarkey, Horse and Jockey, Thurles, Co. Tipperary.	9 16 11¾	1,257	17	209.5

Section II.—White Wyandotte (Station Holders).

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	£ s. d. 10 6 2	1,322	38	220.3
Second Prize (£7) Miss M. O'Keeffe, Ballybooden, Knocktopher, Co. Kilkenny.	10 2 8¼	1,312	94	218.7
Third Prize (£5) Mrs. M. Drohan, Ballynevin, Carrick-on-Suir, Co. Waterford.	9 16 8¾	1,265	16	210.8
Fourth Prize (£4) Miss A. Hanly, Cappa House, Cahir, Co. Tipperary.	9 13 8½	1,261	4	210.2
Fifth Prize (£2) Miss B. Quain, Anglesboro, Co. Limerick, *via* Mitchelstown.	9 12 11	1,257	33	209.5

Section III.—Rhode Island Red.

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
First Prize (£10) Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.	£ s. d. 10 14 8¾	1,413	32	235.5
Second Prize (£7) Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	9 10 11	1,260	86	210.0
Third Prize (£5) Mrs. M. A. Miller, Millview, Rathowen, (Co. Longford).	9 4 5½	1,199	7	199.8

Section IV.—Rhode Island Red (Station Holders).

Name and Address of Owner	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No of Eggs per Bird
First Prize (£10) Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo.	£ s. d. 10 7 11½	1,345	61	224.2
Second Prize (£7) Capt. H. M. S. Redmond, Popefield, Athy, (Laoighis).	10 7 4	1,368	175	228.0
Third Prize (£5) Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	10 6 2	1,344	36	224.0
Fourth Prize (£4) Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	10 1 8¾	1,302	112	217.0

Section V.—Any Non-Sitting Breed.

Name and Address of Owner	Breed	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
		£ s. d.			
First Prize (£10) Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry.	White Leghorn	9 6 4	1,221	81	203.5
Second Prize (£7) Mrs. W. Byrne, Kilcar, Curraghboy, Athlone, Co. Roscommon.	White Leghorn	9 0 11½	1,202	181	200.3
Third Prize (£5) Sister in Charge, R.D.E. School, Swinford, Co. Mayo.	White Leghorn	8 16 11¼	1,169	108	194.8
Fourth Prize (£4) Miss K. Cunningham, Monreade P. F., Greenhills, Kill, Co. Kildare.	White Leghorn	8 14 11	1,148	20	191.3

Section VI.—Any Other General Purpose Breed.

Name and Address of Owner	Breed	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
		£ s. d.			
First Prize (£10) Sister-in-Charge, St. Martha's College, Sion, Navan, Co. Meath.	Light Sussex	10 1 8¾	1,304	170	217.3
Second Prize (£7) Mrs. J. Hely-Hutchinson, Lissen Hall, Swords, Co. Dublin.	Light Sussex	9 9 7	1,248	83	208.0
Third Prize (£5) Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.	Light Sussex	9 0 0½	1,178	21	196.3
Fourth Prize (£4) Mrs. M. Riordan, Glenleigh, Clogheen, Co. Tipperary.	Light Sussex	8 8 10½	1,103	77	183.8

SPECIAL PRIZES.

The Special Prize of a Silver Cup (or its value, £10) for the *Pen* of pullets laying eggs of the highest market value during the Test has been awarded to Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford for Pen No. 61 (Rhode Island Red) which laid 1,413 eggs, value £10 14 8¾d., and which also won first prize in Section III.

The Special Prize of a Silver Medal (or £2) for the *Pen* of pullets of non-sitting breed laying the highest number of first grade eggs during the period from 1st October to 29th December, inclusive, has been awarded to Mrs. M. O'Shea, Farrantane, Castlegregory. Co. Kerry for Pen No. 84 (White Leghorn) which laid 265 first grade eggs during this period.

The Special Prize of a Silver Medal (or £2) for the *Pen* of pullets of sitting breed laying the highest number of first grade eggs during the period from 1st October to 29th December, inclusive, has been awarded to Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare for Pen No. 38 (White Wyandotte) which laid 362 first grade eggs during this period.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of non-sitting breed laying the highest number of first grade eggs during the Test has been awarded to Mrs. W. Byrne, Kilcar, Curraghboy, Athlone, Co. Roscommon, for Pullet No. 497 (Pen No. 85, White Leghorn) which laid 244 first grade eggs.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of sitting breed laying the highest number of first grade eggs during the Test has been awarded to Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo, for Pullet No. 469 (Pen No. 81, Rhode Island Red) which laid 285 first grade eggs.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of non-sitting breed laying the highest number of first grade eggs during the period 1st October to 29th December, inclusive, has been awarded to Mrs. W. Byrne, Kilcar, Curraghboy, Athlone, Co. Roscommon, for Pullet No. 497 (Pen No. 85, White Leghorn) which laid 65 first grade eggs during this period.

The Special Prize of a Silver Medal (ór £2) for the *Individual Bird* of sitting breed laying the highest number of first grade eggs during the period 1st October to 29th December, inclusive, has been awarded to Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo for Pullet No. 469 (Pen No. 81, Rhode Island Red) which laid 83 first grade eggs during this period.

COPPER RINGS AND SPECIAL CERTIFICATES OF MERIT.

Particulars of 139 pullets which laid **200** first grade eggs or over, and which were awarded Copper Rings and Special Certificates.

Table IX.

White Wyandotte (66 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Second Grade	Total	
1	1	2134	60	143	21	224	Mrs. M. Stanton, Woodlands, Glanmire, Co. Cork.
2	7	2135	214	5	1	220	Miss M. O'Brien, Moycarkey, Horse and Jockey, Thurles, Co Tipperary.
	10	2136	181	61	2	244	
	11	2137	120	87	7	214	
	12	2138	173	64	4	241	
3	18	2139	121	80	4	205	Mrs. J. Lynskey, Prospect, Barnaderg, Tuam, Co. Galway.
4	23	2140	196	14	2	212	Mr. W. Barron, "Woodview," Gortrush, Piltown, Co. Kilkenny.
5	26	2141	185	73	3	261	Sister-in-Charge, St. Martha's College, Sion, Navan, Co. Meath.
6	31	2142	160	84	1	245	Miss B. Quain, Anglesboro, Co. Limerick, *via* Mitchelstown.
	32	2143	226	35	1	262	
7	40	2144	192	10	1	203	Mr. L. Hally, The Cottage, Kells, Thomastown, Co. Kilkenny.
	41	2145	111	121	3	235	
10	56	2146	87	113	14	214	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.
	57	2147	223	19	—	242	
	58	2148	186	16	2	204	
	59	2149	71	145	3	219	
	60	2150	97	116	8	221	
11	62	2151	147	86	17	250	Mrs. J. R. Boyd, The Rectory, Killaloe, Co. Clare.
	66	2152	164	59	8	231	
12	76	2153	173	28	—	201	Miss V. Burdon, The Laurels, Buttevant, Co. Cork.
	78	2154	287	2	—	289	

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Second Grade	Total	
14	80 82 83	2155 2156 2157	41 190 122	182 22 104	17 3 3	240 215 229	Mrs. A. M. Murray, Tanderagee, Enfield, Co. Meath.
15	87 88	2158 2159	173 138	44 74	— 2	217 214	Miss K. Newman, Drinadaly, Trim, Co. Meath.
17	97 98 101	2160 2161 2162	197 26 156	18 185 83	— 28 1	215 239 240	Mrs. L. P. Cox, Clonlara, Saggart, Co. Dublin.
19	104 108	2163 2164	128 217	93 12	6 1	227 230	Miss M. O'Brien, Moycarkey, Horse and Jockey, Thurles, Co. Tipperary.
20	112	2165	232	17	—	249	Mr. W. Barron, "Woodview," Gortrush, Piltown, Co. Kilkenny.
22	121 123	2166 2167	237 112	21 98	— 1	258 211	Mrs. M. E. Bailey, Gortboy House, Kilmallock, Co. Limerick.
24	136 137 138	2168 2169 2170	27 53 207	181 199 35	17 5 —	225 257 242	Miss B. Quain, Anglesboro, Co. Limerick, *via* Mitchelstown.
25	139 142 143	2171 2172 2173	210 62 193	29 159 34	4 15 3	243 236 230	Mr. L. Hally, The Cottage, Kells, Thomastown, Co. Kilkenny
26	146	2174	187	16	2	205	Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan.
29	164 167	2175 2176	41 210	195 60	9 1	245 271	Mrs. B. Martin, Corglass, Kingscourt, Co. Cavan.
30	171 172 173 174	2177 2178 2179 2180	92 13 101 134	131 207 125 106	29 31 6 6	252 251 232 246	Miss M. O'Keeffe, Ballybooden, Knocktopher, Co. Kilkenny.
33	183 184	2181 2182	215 105	14 95	1 10	230 210	Miss M. Tohall, Surgalstown House, St. Margaret's, Co. Dublin.

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
34	188 189 190	2183 2184 2185	188 22 203	14 217 —	1 30 —	203 269 203	Miss M. Mulcahy, Abbeyview, Clonmel, (Co. Waterford).
36	200	2186	86	119	3	208	Mrs. K. O'Driscoll, Lisloose, Tralee, Co. Kerry.
37	205 210	2187 2188	153 146	70 97	3 11	226 254	Mrs. M. Connolly, Carrigamore, Corvalley, Dundalk, (Co. Monaghan.)
38	211 214 216	2189 2191 2192	20 116 134	192 153 88	12 4 16	224 273 238	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.
40	224	2193	141	85	2	228	Mrs. M. Drohan, Ballynevin, Carrick-on-Suir, Co. Waterford.
41	232	2194	48	170	26	244	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.
42	236 237	2195 2196	15 108	209 106	39 5	263 219	Mrs. M. Lynch-O'Gorman, Ballinamona, Mitchelstown, Co. Cork.
44	248	2197	45	170	24	239	Miss K. Newman, Drinadaly, Trim, Co. Meath.
45	256	2198	129	115	—	244	Mrs. B. McKenna, Giltown, Navan, Co. Meath,
46	263	2199	170	39	1	210	Mr. M. Burchael, Kill, Co. Kildare.
47	269	2200	143	73	—	216	Miss A. Hanly, Cappa House, Cahir, Co. Tipperary.

Rhode Island Red (55 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
48	271	2201	180	45	2	227	Mrs. K. Cuddihy, Glenmore. Co. Kilkenny.
49	280	2202	191	19	3	213	Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.
50	283 286	2203 2204	102 46	105 168	3 6	210 220	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
53	303	2205	112	112	6	230	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.
54	307 310 311 312	2206 2207 2208 2209	157 106 69 74	46 125 135 151	1 — 5 —	204 231 209 225	Mrs. M. A. Miller, Millview, Rathowen, (Co. Longford).
55	313 317 318	2210 2211 2212	69 201 202	135 1 7	9 — —	213 202 209	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.
56	319 320 323	2213 2214 2215	180 92 122	21 121 139	4 37 2	205 250 263	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.
59	337 339	2216 2217	164 177	77 39	2 3	243 219	Capt. H. M. S. Redmond, Popefield, Athy, (Laoighis).
61	349 352 353 354	2218 2219 2220 2221	64 178 84 118	196 50 127 151	13 4 5 3	273 232 216 272	Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.
62	356	2222	12	194	34	240	Miss V. Burdon, The Laurels, Buttevant, Co. Cork.
64	368 371 372	2223 2224 2225	194 171 121	16 43 117	2 3 2	212 217 240	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Second Grade	Eggs Laid: Total	Name and Address of Owner
65	374 375	2226 2227	161 56	84 148	13 9	258 213	Mr. R. M. Burke, Toghermore P. F., Tuam, Co. Galway.
66	380 383	2228 2229	56 155	170 63	3 1	229 219	Mrs. M. Cruite, Tulla, Three Castles, Co. Kilkenny.
67	385 390	2230 2231	215 134	29 112	— 6	244 252	Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.
68	391 392 393 394	2232 2233 2234 2235	75 171 83 97	147 50 140 136	1 2 5 6	223 223 228 239	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
72	417 420	2236 2237	5 13	215 218	15 18	235 249	Mrs. H. M. Langrell, Killinure, Tullow, (Co. Wicklow).
73	424 425	2238 2239	97 166	105 69	5 10	207 245	Mrs. C. Healy, Bweeng P.O., Mallow, Co. Cork.
74	428 431	2240 2241	94 108	124 95	7 4	225 207	Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.
75	435	2242	198	19	1	218	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.
76	439 442 444	2243 2244 2245	164 113 36	39 122 201	3 4 44	206 239 281	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.
77	445 448 449	2246 2247 2248	6 42 124	231 169 88	47 8 3	284 219 215	Capt. H. M. S. Redmond, Popefield, Athy, (Laoighis).
80	465 467 468	2249 2250 2251	78 135 50	131 87 175	— 2 9	209 224 234	Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Second Grade	Total	
81	469 471	2252 2253	50 138	235 93	4 5	289 236	Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo.
82	477 478	2254 2255	34 23	215 193	11 17	260 233	Mrs. E. M. O'Flynn, Prohurst House, Milford, Charleville, Co. Cork.

White Leghorn (10 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Second Grade	Total	
83	483	1784	93	118	12	223	Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.
84	491	1785	59	147	16	222	Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry.
85	497	1786	92	152	7	251	Mrs. W. Byrne. Kilcar, Curraghboy, Athlone, Co. Roscommon.
86	500	1787	89	164	10	213	Mrs. M. Hanly, Cooga, Doon, Co. Limerick.
88	505 508	1788 1789	195 88	40 127	3 5	238 220	Miss K. Cunningham, Monreade P. F., Greenhills, Kill, Co. Kildare.
89	512 516	1790 1791	104 81	105 123	19 30	228 234	Sister-in-Charge, R. D. E. School, Swinford, Co. Mayo.
97	559	1792	34	195	16	245	Mrs. M. A. Forster, Tattybrack, Rockcorry, Co. Monaghan.

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid Special Grade	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total	Name and Address of Owner
"	567	1793	116	86	20	222	Rev. Bro Dominick, Agricultural College, Mountbellew, Co. Galway.

Light Sussex (7 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid Special Grade	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total	Name and Address of Owner
102	593	2256	210	3	—	213	Sister-in-Charge, Coolarne Tech. School, Athenry, Co. Galway.
103	596 600	2257 2258	118 82	88 150	1 14	207 246	Sister-in-Charge, St. Martha's College, Sion, Navan, Co. Meath.
105	612	2259	55	178	16	249	Mrs. J. Hely-Hutchinson, Lissen Hall, Swords, Co. Dublin.
107	620	2260	186	41	1	228	Mrs. M. Riordan, Glenleigh, Clogheen, Co. Tipperary.
108	629	2261	65	160	5	230	Miss E. Walsh, Ballylemon Lodge, Cappagh, Co. Waterford.
112	695	2262	88	141	6	235	Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.

Barred Rock (1 Pullet).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid Special Grade	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total	Name and Address of Owner
116	673	2263	27	186	9	222	Mrs. N. Browne, Burrane Lower, Knock, Ennis, Co. Clare.

CERTIFICATES OF MERIT.

Particulars of pullets which laid 200 first grade eggs and over, and which were awarded Special Certificates are shown in Table IX.

Pullets which laid 170 but less than 200 first grade eggs and which were awarded Certificates are shown in the following table.

Table X.

White Wyandotte.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. M. Stanton, Woodlands, Glanmire, Co. Cork.	1	2	188	5	193
Miss M. O'Brien, Moycarkey, Horse and Jockey, Thurles, Co. Tipperary.	2	8	184	1	185
Mrs. J. Lynskey, Prospect, Barnaderg, Tuam, Co. Galway.	3	17	176	33	209
Mr. W. Barron, "Wood View," Gortrush, Piltown, Co. Kilkenny.	4	24	170	—	170
Mr. L. Hally, The Cottage, Kells, Thomastown, Co. Kilkenny.	7	37 39 42	173 192 171	1 1 34	174 193 205
Mrs. G. Reddy, St. Wolstan's, Celbridge, Co. Kildare.	8	43	181	—	181
Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	10	55	190	1	191
Mrs. A. M. Murray, Tanderagee, Enfield, Co. Meath.	14	70	189	2	191
Mrs. L. P. Cox, Clonlara, Saggart, Co. Dublin.	17	102	175	5	180

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mr. W. Barron, "Wood View," Gortrush, Piltown, Co. Kilkenny.	20	113	172	—	172
Mrs. J. Fahy, Corbally, Ballyglunin, Co. Galway.	21	118	193	—	193
Mrs. M. E. Bailey, Gortboy House, Kilmallock, Co. Limerick.	22	122	192	8	200
Mrs. K. Byrne, Balgaddy, Clondalkin, Co. Dublin.	23	128	185	—	185
Miss B. Quain, Anglesboro', *via* Mitchelstown, Co. Limerick.	24	133	186	1	187
Mr. L. Hally, The Cottage, Kells, Thomastown, Co. Kilkenny.	25	141	198	10	208
Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan.	26	145	197	5	202
Mrs. E. M. J. Condron, Knocktemple, Virginia, Co. Cavan.	27	152 156	170 180	21 5	191 185
Mrs. B. Martin, Corglass, Kingscourt, Co. Cavan.	29	166 168	197 186	45 —	242 186
Miss M. O'Keeffe, Ballybooden, Knocktopher, Co. Kilkenny.	30	169	177	19	196
Miss M. Tohall, Surgalstown House, St. Margarets', Co. Dublin.	33	182	171	33	204
Miss M. Mulcahy, Abbeyview, Clonmel, (Co. Waterford).	34	191	177	3	180
Mrs. K. O'Driscoll, Lisloose, Tralee, Co. Kerry.	36	203	183	—	183
Mrs. M. Connolly, Carrigamore, Corvally, Dundalk, (Co. Monaghan).	37	206 207	185 182	9 16	194 198
Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	38	212 215	199 181	4 1	203 182

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. M. Drohan, Ballynevin, Carrick-on-Suir, Co. Waterford.	40	226	187	2	189
Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.	41	231	184	28	212
Miss K. Newman, Drinadaly, Trim, Co. Meath.	44	247	187	19	206
Mrs. B. McKenna, Giltown, Navan, Co. Meath.	45	255 258	173 185	— 4	173 189
Mr. M. Burchael, Kill, Co. Kildare.	46	262	175	3	178
Miss A. Hanly, Cappa House, Cahir, Co. Tipperary.	47	265 270	186 198	1 —	187 198

Rhode Island Red.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. K. Cuddihy, Glenmore, Co. Kilkenny.	48	273 274	184 187	39 29	223 216
Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.	49	279	192	—	192
Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	50	284	189	—	189
Mrs. C. L. Cardew, Castleffogarty, Thurles, Co. Tipperary.	51	289	187	12	199
Mrs. D. C. Chearnley, Salterbridge P. F., Ballynadygne, Lismore, Co. Waterford.	52	297 300	174 175	1 4	175 179
Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.	55	314 315	177 190	— 3	177 193
Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	56	324	196	—	196

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Eggs Laid Total
Major R. E. Barrow, Milestown, Castlebellingham, Co. Louth.	57	325	177	31	208
Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.	58	333	197	1	198
Capt. H. M. S. Redmond, Popefield, Athy, (Laoighis).	59	340	185	21	206
Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.	61	351	197	1	198
Miss V. Burdon, The Laurels, Buttevant, Co. Cork.	62	358	193	7	200
Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.	64	369	176	2	178
Mr. R. M. Burke, Toghermore P. F., Tuam, Co. Galway.	65	376 378	187 171	— 5	187 176
Mrs. M. Cruite, Tulla, Three Castles, Co. Kilkenny.	66	384	188	1	189
Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.	67	387	173	3	176
Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	68	395	195	17	212
Mrs. H. M. Langrell, Killinure, Tullow, (Co. Wicklow).	72	415	190	4	194
Mrs. C. Healy, Bweeng P. O., Mallow, Co. Cork.	73	421 422	183 184	2 21	185 205
Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.	74	432	187	1	188

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.	75	433 434 438	179 181 191	— 25 5	179 206 196
Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	76	441 443	182 184	18 43	200 227
Capt. H. M. S. Redmond Popefield, Athy, (Laoighis).	77	446	182	1	183
Mrs. N. Barry, Ballyarthur House, Fermoy, Co. Cork.	78	451	191	1	192
Miss K. Cannon, Ballyedmonduff, Sandyford, Co. Dublin.	79	458 460	198 192	— —	198 192
Mrs. M. O'Grady, Islandeady, Castlebar, Co. Mayo.	81	470 472 474	197 198 178	14 7 24	211 205 202

White Leghorn.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	83	486	193	4	197
Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry.	84	487 489 492	179 175 187	1 7 15	180 182 202
Miss K. Cunningham, Monreade P. F., Greenhills, Kill, Co. Kildare.	88	507	178	2	180
Sister-in-Charge, R. D. E. School, Brabazon Park, Swinford, Co. Mayo.	89	514	181	30	211
Mrs. A. M. Nelson, Derry, Shercock, Co. Cavan.	90	521	194	27	221

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mr. D. A. Dennis, The Burrow, Portrane, Donabate, Co. Dublin.	92	529 531	195 194	4 32	199 226
Mrs. M. E. Shanley, Dromard, Dromod, Co. Leitrim.	93	535 538	191 173	1 8	192 181
Miss K. Cunningham, Monreade P.F., Greenhills, Kill, Co. Kildare.	94	541	173	16	189
Mrs. A. M. Nelson, Derry, Shercock, Co. Cavan.	95	550	198	5	203
Miss A. M. Dempster, Emo Park, Portarlington, Laoighis.	96	556	187	4	191
Mrs. M. A. Forster, Tattybrack, Rockcorry, Co. Monaghan.	97	563 564	182 193	4 16	186 209
Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	98	565 566 570	177 186 183	4 28 39	181 214 222
Mrs. M. E. Higgins, Carramarla, Claremorris, Co. Mayo.	100	578 580	178 179	6 13	184 192

Light Sussex.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. L. Hastings, Friarstown House, Limerick.	101	587	196	12	208
Sister-in-Charge, St. Martha's College, Sion, Navan, Co. Meath.	103	597	195	10	205

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. M. Riordan, Glenleigh, Clogheen, Co. Tipperary.	107	619 621	170 197	11 5	181 202
Miss E. Walsh, Ballylemon Lodge, Cappagh, Co. Waterford.	108	628	196	7	203
Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.	112	692	190	—	190

Buff Rock.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. A. Coleman, Ballycullen House, Croom, Co. Limerick.	114	649 650	170 184	18 7	188 191

Barred Rock.

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. M. A. Kelly, Carranstown, Ballivor, Co. Meath	117	686	186	3	189

Table XI.

Number and percentage of Pullets of each Breed which qualified for Certificates of Merit.

Breed	Number of Pullets for full Period	Number of Certificates Awarded	Percentage of Pullets awarded Certificates	Percentage Distribution	
				Special Certificates	Certificates
			%	%	%
White Wyandotte ..	236	104	44.1	28.0	16.1
Rhode Island Red ...	187	92	49.2	29.4	19.8
White Leghorn ...	97	31	32.0	10.3	21.7
Light Sussex ...	66	13	19.7	10.6	9.1
Buff Rock ...	14	2	14.3	—	14.3
Barred Rock	11	2	18.2	9.1	9.1
All Breeds ...	611	244	39.9	22 7	17.2

TABLE XII.

Results of post-mortem examinations performed by the Veterinary College on pullets that died.

Date of Death	Number of Pullet	Number of Pen	Breed	Result of Post-mortem Examination
1939				
Oct. 6	572	99	White Leghorn	Tapeworm infestation and visceral gout.
,, 9	249	44	White Wyandotte	Impaction of the intestines.
,, 11	217	39	White Wyandotte	Visceral gout.
Nov. 3	220	39	White Wyandotte	Neuro-Lymphomatosis.
,, 9	95	16	White Wyandotte	Lymphomatosis of the heart and breast muscles.
,, 18	193	35	White Wyandotte	Nephritis.
Dec. 9	202	36	White Wyandotte	Visceral gout and tapeworm infestation.
,, 11	602	104	Light Sussex	Visceral gout.
1940				
Jan. 3	381	66	Rhode Island Red	Rupture of a blood tumour.
,, 9	163	29	White Wyandotte	Peritonitis.
,, 16	21	4	White Wyandotte	Tapeworms in the bowel.
,, 29	92	16	White Wyandotte	Tumours (sarcomata).
Feb. 5	198	35	White Wyandotte	Lymphomatosis.
,, 10	584	101	Light Sussex	Visceral gout.
,, 16	615	106	Light Sussex	Roundworm and tapeworm infestation.
,, 17	196	35	White Wyandotte	Tapeworm infestation.
,, 29	4	1	White Wyandotte	Ulceration of the intestine.
Mar. 4	99	17	White Wyandotte	Visceral gout and tapeworm infestation.
,, 6	18	3	White Wyandotte	Pneumonia.
,, 7	48	8	White Wyandotte	Pneumonia.
,, 11	804	53	Rhode Island Red	Leukaemia.
,, 19	658	115	Buff Rock	Gout.
,, 19	204	36	White Wyandotte	Lymphomatosis of the ovary.
,, 21	219	39	White Wyandotte	Leukaemia.
,, 23	77	12	White Wyandotte	Internal haemorrhage caused by blood tumours in the liver.
,, 26	240	42	White Wyandotte	Peritonitis, oviductitis, and gout.
April 1	552	95	White Leghorn	Sarcomata.
,, 11	809	54	Rhode Island Red	Peritonitis and oviductitis.
,, 25	676	116	Barred Rock	Congestion of the lungs.
May 3	29	5	White Wyandotte	Peritonitis and oviductitis.
,, 4	573	99	White Leghorn	Tapeworm infestation.
,, 8	49	9	White Wyandotte	Peritonitis.
,, 16	468	80	Rhode Island Red	Visceral gout.
,, 17	648	111	Light Sussex	Tuberculosis and visceral gout.
,, 20	592	102	Light Sussex	Visceral gout.
,, 24	482	83	White Leghorn	Fowl pox.
,, 27	197	35	White Wyandotte	Tuberculosis.
,, 27	261	46	White Wyandotte	Nephritis.

Date of Death	Number of Pullet	Number of Pen	Breed	Result of Post-mortem Examination
1940				
June 7	651	114	Buff Rock	Peritonitis.
„ 10	683	18	White Wyandotte	Acute peritonitis.
„ 14	666	118	Buff Rock	Blood tumours in the liver.
„ 21	684	18	White Wyandotte	Inflammation of the egg passage.
July 2	662	118	Buff Rock	Visceral gout.
„ 8	195	35	White Wyandotte	Nephritis.
„ 8	243	43	White Wyandotte	Nephritis.
„ 10	327	57	Rhode Island Red	Chronic peritonitis.
„ 15	539	93	White Leghorn	Peritonitis.
„ 19	364	63	Rhode Island Red	Tuberculosis.
„ 22	179	31	White Wyandotte	Rupture of fatty liver.
„ 24	253	45	White Wyandotte	Aspergillosis.
„ 25	53	9	White Wyandotte	Jaundice.
„ 25	120	21	White Wyandotte	Gouty nephritis and impaction of the gizzard.
„ 29	96	16	White Wyandotte	Lymphomatosis of the ovary.
„ 29	366	63	Rhode Island Red	Peritonitis.
„ 30	636	109	Light Sussex	Peritonitis.
Aug. 7	5	1	White Wyandotte	Peritonitis and Lymphomatosis of the ovary.
„ 12	365	63	Rhode Island Red	Peritonitis.
„ 13	110	20	White Wyandotte	Peritonitis.
„ 13	361	63	Rhode Island Red	Fowl pox.
„ 16	272	48	Rhode Island Red	Blood tumours or haemangiomata of the liver.
„ 16	373	65	Rhode Island Red	Peritonitis.

Table XIII.

Number and Percentage of Deaths for each Breed.

Breed	Number of Pullets Penned	Number of Deaths	Percentage of Deaths
			%
White Wyandotte	270	34	12.6
Rhode Island Red	198	11	5.6
White Leghorn	102	5	4.9
Light Sussex	72	6	8.3
Buff Rock	18	4	22.2
Barred Rock	12	1	8.3
All Breeds	672	61	9.1

SECTION I.—WHITE WYANDOTTE.—17 PENS.

Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz	Weight: At close of test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov 25	Nov. 26–Dec. 23	Dec 24–Jan 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4 Aug. 17.	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet s. d	Average Weight of Eggs per Pullet oz dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
6	Miss B. Quain,	1939 Feb. 11	31	5 6	7 0	23	23	23	21	20	23	24	21	19	20	19	9	160	84	1	245	73	38 4¼	2 4	(a) 1,299	1	—	Aug., *June*
	Anglesboro',	,,	32	5 12	7 4	22	22	21	23	17	25	27	26	25	23	20	11	226	35	1	262	70	40 7¼	2 5	lb oz. dr.	—	—	*June*
	via Mitchelstown,	,,	33	4 8	4 12	—	21	21	17	17	20	23	23	16	13	22	2	35	153	7	195	44	30 4	2 2	(b) 187 11 12	—	1	Oct., *June*
	Co. Limerick.	,,	34	4 14	7 4	—	19	22	23	21	21	20	16	4	2	11	—	151	8	—	159	46	25 5¼	2 6	oz.	—	—	Oct., June
		,,	35	5 6	7 4	24	24	23	24	23	22	27	25	23	20	21	10	182	84	—	266	77	41 6¼	2 4	(c) 27.7	—	—	*June*
		,,	36	4 14	6 0	—	3	18	20	13	18	19	21	20	16	17	7	171	1	—	172	26	26 0¼	2 10	(d) £10 2 5	—	—	Oct.
10	Mrs. K. F. Graham,	1939 Mar. 18	55	5 0	6 0	7	17	21	20	18	20	22	22	14	17	3	10	167	23	1	191	49	30 3	2 5	(a) 1,201	—	2	Oct., Aug., *June*
	Ballagh Lodge,	Feb. 23	56	5 0	5 12	27	12	21	22	23	23	21	23	3	20	7	12	87	113	14	214	52	33 1	2 3	lb. oz. dr.	—	2	Aug., *June*
	Donadea,	,,	57	4 12	5 4	21	23	22	21	19	21	24	22	21	18	20	10	223	19	—	242	71	37 8¼	2 5	(b) 181 1 13	—	—	*June*
	Co. Kildare.	,,	58	4 8	5 8	—	16	21	16	20	21	20	23	12	22	22	11	186	16	2	204	41	31 4¼	2 5	oz.	—	—	Oct., *June*
		,,	59	4 8	5 9	16	17	19	17	20	20	18	22	23	16	20	11	71	145	3	219	52	33 11¼	2 3	(c) 26 9	—	1	*June*
		Mar. 18	60	5 1	5 8	11	19	20	19	17	19	22	24	21	20	19	10	97	116	8	221	46	34 3¼	2 3	(d) £10 0 8½	2	—	Oct., *June*
11	Mrs. J. R. Boyd,	1939 Mar. 18	61	4 8	5 8	19	20	20	18	17	20	22	21	14	9	16	8	4	104	96	204	25	30 1	2 0	(a) 1,293	2	2	*Aug.*
	The Rectory,	,,	62	4 12	6 0	23	21	21	21	19	19	21	22	24	23	25	11	147	86	17	250	53	38 5¼	2 3	lb. oz. dr.	—	—	*June*
	Killaloe,	,,	63	4 8	5 4	—	—	23	24	23	25	26	24	17	19	14	—	101	91	3	195	27	29 5¼	2 4	(b) 174 8 3	—	—	Oct., *Aug., June*
	Co. Clare	,,	64	4 14	6 8	21	22	16	20	21	20	22	14	16	16	9	10	102	72	33	207	29	31 11¼	2 2	oz.	1	3	June
		,,	65	4 10	5 8	—	3	23	19	21	21	20	24	23	22	20	10	71	123	12	206	21	30 11	2 3	(c) 25.9	—	—	*Oct., June*
		,,	66	4 8	6 0	10	25	22	22	21	20	24	23	20	13	21	10	164	59	8	231	54	36 1¼	2 4	(d) £9 17 0	—	—	Oct., *June*
2	Miss M. O'Brien,	1939 Mar. 1	7	4 8	5 12	7	21	20	19	20	21	23	23	20	19	19	8	214	5	1	220	51	34 3	2 8	(a) 1,257	—	—	Aug., *June*
	Moycarkey,	,,	8	4 12	6 8	—	16	21	16	22	22	23	23	4	17	14	7	177	7	1	185	38	28 8	2 6	lb. oz. dr.	—	1	June
	Horse and Jockey,	,,	9	4 14	7 4	8	23	19	17	15	18	11	14	10	10	8	—	128	23	2	153	50	24 11¼	2 5	(b) 182 4 7	—	—	Oct., June
	Thurles,	,,	10	4 8	5 12	25	23	19	20	21	20	24	23	21	20	18	10	181	61	2	244	69	38 0	2 4	oz.	—	—	Aug., *June*
	Co. Tipperary.	,,	11	4 8	6 2	5	20	23	23	21	21	22	17	21	18	16	7	120	87	7	214	47	33 5¼	2 4	(c) 27.8	—	—	Aug.
		,,	12	4 8	6 0	24	22	22	20	20	20	20	24	24	18	20	7	173	64	4	241	68	37 7¼	2 4	(d) £9 16 11½	—	—	*June*
14	Mrs. A. M. Murray,	1939 Feb. 25	79	5 14	7 0	19	20	20	20	20	17	18	18	12	1	17	9	186	3	2	191	61	30 1¼	2 8	(a) 1,256	—	—	June
	Tanderagee,	,,	80	5 10	6 4	22	22	19	18	16	18	23	25	24	22	21	10	41	182	17	240	54	36 9¼	2 2	lb. oz. dr.	—	—	*Aug.*
	Enfield,	,,	81	5 13	6 2	16	4	—	14	17	25	26	22	8	12	—	5	64	67	18	149	13	21 11	2 3	(b) 175 0 1	—	—	June
	Co. Meath.	Feb. 17	82	5 12	8 0	24	19	19	19	19	20	19	20	18	15	16	7	190	22	3	215	64	33 7¼	2 7	oz.	—	—	*June*
		Feb. 20	83	5 13	6 14	21	19	20	19	18	16	22	23	23	18	20	10	122	104	3	229	61	35 5¼	2 3	(c) 26.8	—	—	*June*
		Mar. 1	84	5 8	6 0	19	22	18	17	17	19	23	23	22	21	21	10	4	159	69	232	29	34 6¼	2 0	(d) £9 12 5½	—	—	*Aug.*

SECTION I.—WHITE WYANDOTTE—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of test lb. oz.	Eggs Laid: Oct. 1-Oct 28	Oct 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug. 3	Aug. 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
6	7	Mr. L. Hally,	1939 Feb.	37	6 6	8 4	—	9	21	10	2	23	23	25	22	19	17	3	105	68	1	174	32	26 8¼	2 4	(a) 1,230	—	—	Oct.,Aug.,*June*
		The Cottage,	,,	38	4 12	5 8	21	19	13	—	18	22	25	24	25	20	22	11	5	161	54	220	9	32 5	2 0	lb oz dr.	—	—	Dec , *June*
		Kells,	,,	39	5 4	6 0	23	18	22	20	16	19	14	13	12	15	15	6	178	14	1	193	66	30 8¾	2 6	(b) 170 0 0	—	—	*June*
		Thomastown,	,,	40	5 8	6 4	18	19	18	16	17	19	21	17	17	16	16	9	192	10	1	203	38	31 8¾	2 6	oz	—	—	*June*
		Co. Kilkenny.	,,	41	6 0	6 0	9	24	22	22	22	20	24	21	24	20	18	9	111	121	3	235	55	36 9½	2 3	(c) 26.5	—	—	Aug., *June*
			,,	42	5 12	5 12	10	22	20	18	22	20	21	19	17	15	16	5	55	116	34	205	24	31 7¼	2 2	(d) £9 9 11¾	2	—	—
7	15	Miss K. Newman,	1939 Feb.	85	4 13	4 12	19	23	23	22	10	17	20	20	17	7	16	2	66	124	6	196	67	31 1¼	2 2	(a) 1,181	—	2	Aug , *June*
		Drinadaly,	,,	86	4 9	4 12	14	20	18	17	18	18	22	18	21	14	20	7	142	58	7	207	50	32 1	2 4	lb oz. dr.	—	—	Oct., June
		Trim,	,,	87	4 8	5 8	21	25	23	18	18	19	19	20	18	14	13	9	173	44	—	217	72	34 5¼	2 4	(b) 160 8 6	—	—	Oct., *June*
		Co. Meath.	,,	88	4 14	6 8	—	10	25	23	23	23	23	20	22	19	16	10	138	74	2	214	37	32 11¾	2 4	oz	—	—	Oct., *Aug.*
			,,	89	4 12	5 8	21	5	7	22	13	20	22	14	12	12	12	6	43	120	3	166	36	24 11½	2 2	(c) 26 1	—	5	Oct.,Feb.,June
			,,	90	5 0	4 12	16	21	15	18	8	18	19	16	21	5	17	7	7	117	57	181	28	27 3	2 0	(d) £9 2 10¾	—	1	June
8	17	Mrs. L. P. Cox,	1939 Feb. 26	97	5 8	6 6	17	19	21	17	21	20	21	18	20	17	16	8	197	18	—	215	61	33 8¼	2 7	(a) 1,155	—	—	*June*
		Clonlara,	,,	98	5 8	6 8	22	20	20	19	19	20	21	21	23	21	22	11	26	185	28	239	52	36 5¼	2 1	lb oz. dr.	—	—	*June*
		Saggart,	,,	99	5 12	D	18	19	21	18	14	D	—	—	—	—	—	—	73	17	—	90	60	15 10½	2 5	(b) 159 14 10	—	—	—
		Co. Dublin.	,,	100	4 12	5 4	21	22	20	11	—	14	24	24	23	5	17	10	9	149	33	191	42	29 3	2 0	oz	2	1	Jan., June
			Feb. 15	101	5 4	6 10	24	22	20	18	17	21	21	25	21	21	20	10	156	83	1	240	68	37 4¾	2 4	(c) 26 6	—	—	*June*
			,,	102	5 4	5 8	23	23	21	19	3	2	24	24	22	5	8	6	138	37	5	180	66	28 6	2 5	(d) £9 1 2	~	—	Jan., June
9	3	Mrs. J. Lynskey,	1939 Feb. 7	13	4 8	D	13	21	23	20	18	12d	—	—	—	—	—	—	13	86	8	107	54	18 7¼	2 1	(a) 1,142	2	—	—
		Prospect,	,,	14	4 8	5 10	20	26	20	23	21	20	21	16	15	11	6	6	16	142	47	205	52	31 9¾	2 0	lb oz. dr.	—	—	*June*
		Barnaderg,	Mar. 7	15	4 8	4 8	20	24	22	20	19	20	23	22	12	20	4	9	36	153	26	215	45	33 7¾	2 1	(b) 149 12 0	—	1	June
		Tuam,	Feb 7	16	4 8	5 0	12	25	21	20	21	23	25	—	20	—	22	12	18	148	35	201	36	31 0¾	2 1	oz.	2	2	June
		Co. Galway.	Mar. 7	17	5 0	5 6	19	17	17	15	17	18	21	22	21	16	17	9	47	129	33	209	23	31 7½	2 2	(c) 25 2	—	—	*June*
			,,	18	4 12	6 0	—	9	22	22	17	21	21	23	22	21	18	9	121	80	4	205	32	31 4¼	2 4	(d) £8 18 2¾	—	—	Oct , *June*
10	8	Mrs. G. Reddy,	1939 Feb 2	43	4 12	5 8	17	21	21	22	16	18	21	16	10	9	6	4	137	44	—	181	64	28 11½	2 4	(a) 1,018	—	—	Aug , *June*
		St. Wolstan's	,,	44	5 14	5 0	17	22	7	—	2	22	24	11	14	15	11	11	19	113	24	156	44	23 10¼	2 1	lb oz dr.	1	3	Dec , *June*
		Celbridge,	,,	45	5 0	4 12	20	18	23	22	21	22	23	24	21	16	19	8	134	100	3	237	63	36 10¾	2 3	(b) 138 0 4	—	—	*Aug.*
		Co. Kildare.	,,	46	6 2	7 0	7	20	18	19	18	19	11	18	14	9	19	8	34	131	15	180	40	28 0	2 2	oz.	—	—	*June*
			,,	47	4 12	5 12	—	13	22	19	20	16	22	26	20	12	10	8	18	154	16	188	37	28 11¾	2 1	(c) 26.0	1	1	Oct., Aug.
			,,	48	5 6	D	—	—	23	20	20	13d	—	—	—	—	—	—	72	4	—	76	27	12 10¾	2 6	(d) £7 19 6¾	—	—	Oct,

D = Dead

SECTION I.—WHITE WYANDOTTE—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz)	Weight: At close of test (lb. oz)	Eggs Laid: Oct 1-Oct. 28	Oct 29-Nov 25	Nov 26-Dec. 23	Dec 24-Jan 20	Jan 21-Feb 17	Feb 18-Mar 16	Mar 17-Apl 13	Apl 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec 29	Value per Pullet (s d.)	Average Weight of Eggs per Pullet (oz dr)	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
11	12	Miss V. Burdon,	1939 Feb. 14	73	5 4	8 8	20	16	18	20	19	18	20	17	14	4	—	—	156	9	1	166	57	26 6	2 6	(a) 1 039	—	—	Aug., *June*
		The Laurels,	,,	74	4 14	4 14	18	20	19	19	17	20	19	23	21	22	19	8	24	150	51	225	28	33 11¼	2 1	lb oz. dr.	—	—	*June*
		Buttevant,	,,	75	5 8	6 12	—	—	10	20	18	21	22	20	18	6	21	9	162	2	1	165	13	24 2¼	2 8	(b) 151 15 11	—	1	Oct., June
		Co Cork.	Jan 25	76	5 12	6 8	20	13	19	21	17	18	19	20	19	12	16	7	173	28	—	201	56	31 2½	2 5	oz	—	—	*June*
			Feb 27	77	6 12	D	—	—	—	—	17	20	6	—	—	—	—	—	42	—	1	43	—	6 5	2 9	(c) 28 1	—	—	Oct.
			Feb. 14	78	5 13	7 4	20	20	20	23	21	22	23	23	24	11	21	11	237	2	—	239	65	37 1¼	2 7	(d) £7 19 5	—	1	*June*
12	5	Sister-in-Charge,	1939 Feb. 16	25	6 4	5 14	6	—	—	—	12	23	18	23	7	25	3	6	88	32	3	123	5	17 0¼	2 4	(a) 981	—	2	Nov., May
		St. Martha's College,	,,	26	5 10	5 14	25	25	24	22	21	23	24	24	22	21	18	12	185	73	3	261	76	40 10	2 4	lb. oz. dr.	—	—	*June*
		Sion,	,,	27	5 6	6 4	24	4	—	9	21	24	25	16	21	8	10	5	111	53	3	167	25	24 7¾	2 4	(b) 138 11 10	—	2	Nov., *June*
		Navan,	,,	28	5 10	4 12	13	4	—	—	9	21	16	22	14	12	8	2	101	18	2	121	15	17 8¾	2 4	oz	—	—	Nov.
		Co. Meath.	Feb 8	29	6 0	D	25	24	18	20	18	23	24	13d	—	—	—	—	161	4	—	165	72	26 11½	2 5	(c) 27 2	—	—	—
			Feb. 16	30	5 3	5 4	23	8	—	—	—	22	25	22	17	11	10	6	75	65	4	144	28	21 3	2 3	(d) £7 0 2¼	—	—	Nov.
†	4	Mr. W. Barron,	1939 Jan. 27	19	6 3	7 0	19	17	15	8	16	19	20	17	21	10	9	4	112	57	6	175	45	27 2¾	2 3	(a) 944	—	—	*June*
		"Wood View,"	,,	20	5 0	5 12	1	23	22	20	24	22	21	23	18	19	15	9	3	130	84	217	13	32 2½	2 0	lb oz. dr.	—	1	Oct., *June*
		Gortrush,	,,	21	5 8	D	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(b) 131 8 7	—	—	Oct.
		Piltown,	,,	22	5 8	6 12	6	21	19	16	17	17	16	15	14	12	10	7	119	46	5	170	44	27 0½	2 4	oz.	—	—	Oct.
		Co. Kilkenny.	,,	23	6 1	6 12	17	19	20	17	18	20	19	20	20	18	17	7	196	14	2	212	58	33 0¾	2 6	(c) 26.8	—	—	July
			,,	24	6 0	6 8	17	17	15	13	15	18	17	10	16	12	15	5	152	18	—	170	51	26 8½	2 6	(d) £7 6 3	1	—	*Aug.*
†	1	Mrs. M. Stanton,	1939 Feb 2	1	5 14	6 4	13	19	19	20	20	22	20	24	21	19	19	8	60	143	21	224	36	34 3¼	2 2	(a) 907	1	—	June
		Woodlands,	Mar 22	2	5 12	7 0	17	22	20	1	11	20	15	19	19	20	20	9	99	89	5	193	55	30 2½	2 3	lb. oz. dr.	—	—	Jan.
		Glanmire,	Mar. 25	3	6 0	4 10	18	21	22	23	22	25	20	15	7	11	10	—	19	159	16	194	55	30 7¾	2 1	(b) 120 2 6	—	2	Aug.
		Co. Cork.	Mar. 4	4	5 12	D	28	25	23	—	—	D	—	—	—	—	—	—	2	27	47	76	29	13 1¾	1 15	oz.	—	—	—
			Feb. 25	5	5 4	D	20	17	16	13	7	—	11	10	—	—	—	D	52	41	1	94	55	15 9½	2 3	(c) 25.4	—	—	Feb.
			,,	6	6 0	7 0	19	14	11	11	7	9	13	14	13	7	6	2	66	55	5	126	40	19 10¼	2 3	(d) £7 3 11	—	—	*Aug.*
*†	0	Mrs. C. P. Chearnley,	1939 Feb 25	49	6 0	D	—	—	12	—	1	18	4	D	—	—	—	—	29	6	—	35	12	6 0	2 5	(a) 840	—	—	Dec., *Oct.*
		Glendoneen,	Mar. 14	50	5 8	5 8	9	21	20	20	19	20	22	20	10	19	4	11	2	45	148	195	2	27 10¼	1 14	lb. oz. dr.	18	2	Aug.
		Ballinhassig,	Feb. 25	51	4 12	6 14	15	22	22	20	18	21	17	17	10	2	1	—	135	28	2	165	61	27 0½	2 5	(b) 110 6 9	1	1	*June*
		Co. Cork.	Feb 14	52	6 14	5 0	11	20	19	22	13	19	22	15	11	—	—	—	86	62	4	152	52	24 7½	2 3	oz.	1	2	June
			Feb. 6	53	6 12	D	18	19	—	10	20	17	15	16	6	—	D	—	2	66	53	121	16	17 11	2 0	(c) 25.2	1	—	Nov., *June*
			Mar. 6	54	4 13	4 12	16	22	19	20	18	18	19	19	18	—	—	3	55	109	8	172	55	27 8½	2 2	(d) £6 11 1¾	1	—	Aug., *June*

*Disqualified under Clause 29 (more than 20 per cent. second grade eggs). †Disqualified under Clause 29 (pen produced less than 960 eggs). D = Dead.

SECTION I.—WHITE WYANDOTTE—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No of Pullet	Weight: On arrival (lb. oz)	Weight: At close of test (lb. oz.)	Eggs Laid: Oct. 1-Oct 28	Oct 29-Nov 25	Nov 26-Dec. 23	Dec 24-Jan 20	Jan 21-Feb 17	Feb 18-Mar 16	Mar 17-Apl 13	Apl 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug. 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen. (b) Total weight. (c) Av weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
			1939																					s d	oz dr.				
*†	16	Mrs. M Stanton,	Mar. 10	91	5 4	4 8	22	21	19	13	—	—	18	22	21	8	13	—	—	30	127	157	12	22 4¼	1 14	(a) 806	6	—	Feb.
		Woodlands,	Feb. 2	92	5 7	D	18	21	8	—	D	—	—	—	—	—	—	—	2	33	12	47	35	8 7	2 0	lb oz. dr.	—	—	—
		Glanmire,	Mar. 10	93	5 12	5 0	20	23	23	21	19	21	22	24	20	19	1	—	12	164	37	213	62	33 3¼	2 0	(b) 101 0 9	—	1	*June*
		Co. Cork.	Mar. 22	94	4 12	4 15	2	1	21	23	24	22	23	12	13	11	14	—	61	99	6	166	28	25 2¼	2 3	oz	—	3	Oct., June
			Mar. 10	95	4 12	D	9	D	—	—	—	—	—	—	—	—	—	—	—	—	9	9	—	1 1¼	1 12	(c) 24 1	—	—	—
			Mar 22	96	5 8	D	16	25	21	22	21	22	23	25	16	12	8D	—	1	113	100	214	21	32 0	1 15	(d) £6 2 7¼	2	2	June
			1939																										
*†	18	Mrs. C. P. Chearnley,	Feb 25	679	6 0	6 8	18	18	16	16	16	10	11	3	4	3	3	2	69	41	10	120	47	19 7	2 4	(a) 794	2	—	*June*
		Glendoneen,	,,	680	5 0	5 0	—	—	—	21	20	21	22	14	19	6	23	2	1	6	141	148	—	18 4¼	1 13	lb oz. dr.	16	1	Oct, *June*
		Ballinhassig,	,,	681	5 4	5 8	—	10	18	6	3	14	10	21	20	10	—	6	52	63	6	121	27	18 1¼	2 3	(b) 104 7 4	—	—	Oct. Aug, *Oct*
		Co. Cork	Mar. 14	682	5 6	4 8	13	—	—	4	9	22	15	17	15	6	9	—	11	80	29	120	—	16 10	2 0	oz	2	3	Oct.
			Feb. 14	683	4 8	D	—	—	12	21	29	22	26	17	18	D	—	—	118	17	1	126	16	29 5¼	2 5	(c) 25 3	—	1	Oct.
			Feb. 25	684	4 9	D	—	17	21	18	19	20	23	20	11	D	—	—	34	88	27	149	16	23 3¼	2 1	(d) £5 16 8¼	—	—	Oct.

*Disqualified under Clause 29 (more than 20 per cent. second grade eggs). †Disqualified under Clause 29 (pen produced less than 960 eggs). D = Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—28 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	38	Mrs. K. F. Graham,	1939 Jan. 26	211	5 5	6 4	23	23	22	20	3	3	24	25	26	21	23	11	20	192	12	224	70	34 6¾	2 1	(a) 1,322	—	—	Feb.
		Ballagh Lodge,	Feb. 23	212	5 0	5 6	18	19	21	19	16	17	18	25	18	11	15	6	162	37	4	203	59	31 11	2 4	lb. oz. dr.	—	—	*June*
		Donadea,	,,	213	4 9	4 12	17	18	23	20	19	21	20	19	17	9	9	10	144	57	1	202	60	31 11¼	2 5	(b) 183 15 9	—	—	June
		Co. Kildare.	,,	214	4 12	5 8	23	21	25	23	20	23	25	28	26	24	23	12	116	153	4	273	72	42 2¼	2 3	oz.	—	—	—
			Mar. 18	215	4 14	6 8	5	18	19	18	13	10	18	18	18	20	17	8	172	9	1	182	46	28 5	2 6	(c) 26.7	—	—	—
			Feb. 23	216	4 9	5 6	21	23	22	22	20	21	23	21	22	18	16	9	134	88	16	238	55	37 1	2 3	(d) £10 6 2	—	—	Oct., *Aug.*
2	30	Miss M. O'Keeffe,	1939 Feb. 15	169	5 12	6 8	16	14	21	20	18	18	24	24	16	6	16	3	59	118	19	196	38	30 0¼	2 2	(a) 1,312	—	2	June, *June*
		Ballybooden,	,,	170	6 9	6 14	12	10	9	18	14	15	19	20	—	15	3	—	110	22	3	135	33	20 9½	2 4	lb. oz. dr.	—	1	May, *Nov.*
		Knocktopher,	,,	171	5 3	5 15	27	26	25	23	21	21	20	22	22	18	18	9	92	131	29	252	56	39 2¼	2 2	(b) 176 14 5	—	—	June
		Co. Kilkenny.	,,	172	5 0	5 10	23	21	23	19	19	24	24	25	24	20	20	9	13	207	31	251	49	38 4¾	2 1	oz.	1	—	Aug., *June*
			,,	173	5 4	6 0	14	22	20	19	19	20	22	23	20	21	20	12	101	125	6	232	55	36 0½	2 3	(c) 25 9	1	—	*June*
			,,	174	5 6	6 8	18	23	22	21	21	23	25	25	25	16	18	9	134	106	6	246	62	38 2¾	2 3	(a) £10 2 8¾	—	2	Aug., *June*
3	40	Mrs. M. Drohan,	1939 Feb.	223	5 0	6 0	19	18	19	19	17	17	20	22	21	18	20	10	165	54	1	220	58	34 1¼	2 4	(a) 1,265	1	—	*June*
		Ballynevin,	,,	224	5 0	5 9	4	24	22	18	22	22	24	21	20	21	22	8	141	85	2	228	52	35 4½	2 3	lb. oz. dr.	—	—	*June*
		Carrick-on-Suir,	,,	225	5 0	5 8	19	16	18	15	16	20	22	21	17	20	20	9	24	180	9	213	51	32 8¼	2 1	(b) 176 0 10	—	—	*June*
		Co. Waterford.	,,	226	5 6	5 2	21	21	22	18	18	19	20	10	18	6	16	—	149	38	2	189	68	29 11½	2 4	oz.	1	2	June
			,,	227	4 8	4 8	1	21	21	21	20	20	19	21	19	18	9	—	167	23	—	190	48	30 0¾	2 5	(c) 26.7	—	—	—
			,,	228	4 8	5 8	—	10	21	21	21	22	24	26	23	23	23	11	171	52	2	225	34	34 2	2 4	(d) £9 16 3½	—	—	Oct., *June*
4	47	Miss A. Hanly,	1939 Feb. 28	265	4 12	5 12	—	—	13	20	18	21	22	21	21	19	21	11	154	32	1	187	16	27 7	2 4	(a) 1,261	—	—	Oct., July
		Cappa House,	Jan. 29	266	5 4	6 14	14	22	24	21	22	22	25	25	23	23	18	10	108	138	3	249	62	38 9¼	2 3	lb. oz. dr.	—	—	Oct., *June*
		Cahir,	,,	267	5 8	6 0	7	23	20	21	20	21	23	18	19	17	18	9	173	43	—	216	55	33 10¼	2 4	(b) 181 3 7	—	—	Oct., *June*
		Co. Tipperary,	,,	268	6 0	6 8	—	8	19	20	17	20	27	22	15	21	19	7	192	3	—	195	32	29 6¾	2 9	oz.	1	—	Oct., *Aug.*
			,,	269	4 8	5 4	19	18	18	17	17	21	20	22	21	19	18	6	143	73	—	216	59	33 6	2 4	(c) 27.6	—	—	July
			,,	270	5 0	6 0	20	17	17	—	7	23	23	25	24	9	21	12	163	35	—	198	54	30 5¼	2 4	(d) £9 13 8½	—	1	June
5	24	Miss B. Quain,	1939 Mar. 2	133	4 10	5 12	—	16	22	16	16	22	24	24	14	17	13	3	79	107	1	187	42	29 1½	2 3	(a) 1,257	—	—	Oct., May
		Anglesboro',	,,	134	4 10	4 0	—	—	14	17	14	17	20	22	19	9	1	—	9	114	10	133	15	19 11	2 1	lb. oz. dr.	—	—	Oct., June
		via Mitchelstown,	,,	135	4 10	6 11	—	8	23	22	22	22	25	21	23	21	19	7	199	14	—	213	36	32 6¼	2 6	(b) 172 15 7	—	—	Oct., *June*
		Co. Limerick.	,,	136	4 8	6 0	—	12	23	20	20	24	24	24	26	18	24	10	27	181	17	225	37	34 1¼	2 2	oz.	—	—	Oct., *June*
			,,	137	4 12	6 0	12	23	25	24	22	24	25	24	23	23	22	10	53	199	5	257	62	40 1¼	2 2	(c) 26.4	—	—	Oct., *June*
			,,	138	4 10	6 8	—	18	22	21	23	24	27	28	25	24	22	8	207	35	—	242	44	37 1½	2 5	(d) £9 12 11	—	—	Oct., *Aug.*

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	No. of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1-Oct. 28	Oct 29-Nov. 25	Nov 26-Dec 23	Dec. 24-Jan 20	Jan. 21-Feb 17	Feb. 18-Mar 16	Mar 17-Apl. 13	Apl. 14-May 11	May 12 June 8	June 9-July 6	July 7-Aug 3	Aug. 4 Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet (s. d)	Average Weight of Eggs per Pullet (oz. dr)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
6	37	Mrs. M. Connolly,	1939 Mar.	205	5 7	6 8	22	20	18	17	16	18	22	22	21	19	20	11	153	70	3	226	61	34 11	2 4	(a) 1,241	—	—	Oct., *June*
		Carrigamore,	,,	206	5 13	7 0	23	11	—	11	23	20	21	24	20	20	11	10	130	55	9	194	26	28 9	2 4	lb. oz. dr.	—	—	Nov., *June*
		Corvalley,	,,	207	6 0	6 12	22	21	22	18	19	19	20	21	11	12	11	2	136	46	16	198	52	31 1½	2 4	(b) 170 1 4	—	—	*June*
		Dundalk,	,,	208	5 2	5 6	4	—	16	23	20	13	22	11	13	10	14	—	38	102	6	146	21	21 10	2 2	oz.	—	4	Oct., July
		(Co. Monaghan).	,,	209	5 4	6 10	23	20	20	17	11	18	22	23	22	17	20	10	38	161	24	223	43	34 2¼	2 2	(c) 26 3	—	—	*June*
			,,	210	5 12	6 10	23	19	24	23	24	19	25	20	25	25	21	6	146	97	11	254	62	39 3	2 3	(d) £9 10 1½	—	—	*June*
7	25	Mr. L. Hally,	1939 Feb.	139	5 2	5 11	22	19	22	22	21	19	21	24	22	22	21	8	210	29	4	243	65	37 8¼	2 5	(a) 1,232	—	—	*June*
		The Cottage,	,,	140	4 8	5 4	19	3	—	7	17	16	19	20	20	18	18	7	5	94	65	164	3	22 7¼	2 0	lb. oz. dr.	2	—	Nov., *Aug.*
		Kells,	,,	141	6 4	7 8	22	21	20	22	22	21	19	17	8	19	8	9	177	21	10	208	58	32 9½	2 4	(b) 169 4 2	—	2	June
		Thomastown,	,,	142	4 12	5 12	18	20	18	19	21	20	24	22	23	23	18	10	62	159	15	236	46	36 1¼	2 2	oz.	—	—	*June*
		Co. Kilkenny.	Mar.	143	5 0	6 8	13	22	22	20	19	19	22	22	23	19	20	9	193	34	3	230	59	35 10¼	2 5	(c) 26 4	—	—	June
			,,	144	5 4	5 14	19	14	15	17	7	—	24	19	—	18	18	—	16	86	49	151	8	22 3¾	2 0	(d) £9 7 5	1	1	Feb., May
8	29	Mrs. B. Martin,	1939 Jan. 9	163	5 4	D	18	16	21	6D	—	—	—	—	—	—	—	—	6	46	9	61	49	11 0½	2 0	(a) 1,210	—	—	Oct.
		Corglass,	,,	164	5 4	5 14	24	23	22	21	19	21	26	25	10	19	24	11	41	195	9	245	67	38 0¼	2 2	lb oz. dr.	—	1	June
		Kingscourt,	,,	165	4 12	5 4	19	24	21	21	20	21	17	17	15	9	12	9	4	89	112	205	19	30 4¼	1 15	(b) 161 9 14	—	5	Oct., June
		Co. Cavan.	,,	166	4 12	5 12	22	23	24	23	23	24	27	28	27	18	—	3	8	189	45	242	50	37 5¼	2 0	oz	—	—	July
			,,	167	5 4	5 12	23	22	23	25	26	26	25	24	24	24	22	7	210	60	1	271	72	42 1¼	2 4	(c) 25.6	—	—	*June*
			,,	168	4 8	5 8	20	3	—	2	17	22	25	24	23	21	20	9	180	6	—	186	23	27 0¾	2 6	(d) £9 6 0½	—	—	Oct., *Aug.*
9	43	Mrs. L. Kennedy,	1939 Feb.	241	5 3	5 6	27	1	—	4	27	26	25	23	14	11	15	—	19	133	21	173	16	24 10¾	2 1	(a) 1,168	—	1	Nov.
		Ballyroe,	,,	242	4 10	5 0	28	27	23	19	19	21	22	25	3	20	16	1	57	122	45	224	41	34 8¼	2 2	lb oz. dr.	—	2	June
		Freshford,	,,	243	4 12	D	22	20	19	18	17	19	20	21	20	20	D	—	17	174	5	196	60	31 1¼	2 1	(b) 161 7 13	—	—	—
		Co. Kilkenny	,,	244	4 13	5 6	24	24	19	20	19	20	18	19	20	21	19	9	225	7	—	232	72	36 5½	2 7	oz.	—	—	*June*
			,,	245	5 4	5 8	19	22	23	19	18	19	21	16	15	5	8	7	167	22	3	192	68	30 7½	2 5	(c) 26 5	1	3	June
			,,	246	5 3	3 8	21	20	19	21	19	16	16	16	3	—	—	—	90	59	2	151	65	24 8	2 3	(d) £9 2 5¼	—	—	May
10	34	Miss M. Mulcahy,	1939 Feb. 10	187	5 8	7 4	15	19	20	18	17	15	14	12	3	—	—	—	49	75	9	133	52	21 9¾	2 2	(a) 1,174	—	1	June
		Abbeyview,	Jan. 8	188	5 4	6 2	11	18	20	18	11	17	21	20	21	20	18	8	188	14	1	203	52	31 7¾	2 5	lb. oz. dr.	—	—	Oct., *June*
		Clonmel,	,,	189	4 12	5 13	25	26	21	21	23	24	26	26	27	14	25	11	22	217	30	269	48	41 2	2 1	(b) 163 13 10	—	—	*June*
		(Co. Waterford).	,,	190	6 2	6 8	16	18	20	17	16	16	20	17	22	18	14	9	203	—	—	203	58	31 8¼	2 11	oz.	—	—	*June*
			Feb. 10	191	5 4	5 6	20	10	25	6	7	—	22	28	28	3	21	10	63	114	3	180	59	27 7	2 3	(c) 26.8	—	1	June
			Feb.	192	4 10	5 4	—	14	22	20	18	21	23	19	15	16	11	7	3	148	35	186	28	28 3¾	2 0	(d) £9 2 2½	—	1	Oct., June

D = Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz)	Eggs Laid: Oct 1–Oct 28	Oct 29–Nov 25	Nov 26–Dec. 23	Dec 24–Jan. 20	Jan. 21–Feb 17	Feb. 18–Mar. 16	Mar 17–Ap. 13	Apl 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug 3	Aug 4–Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
11	33	Miss M. Tohall,	1939 Mar.	181	5 3	6 0	19	24	23	20	18	17	21	22	8	16	5	10	5	126	72	203	11	31 0¼	2 0	(a) 1,164	4	1	Oct , June
		Surgalstown House,	,,	182	5 5	5 15	22	17	20	19	16	16	18	20	17	14	16	9	111	60	33	204	30	31 2	2 3	lb oz dr.	—	—	*June*
		St. Margaret's,	,,	183	6 0	5 15	20	21	22	20	21	19	22	23	20	18	18	6	215	14	1	230	66	35 11¾	2 6	(b) 157 15 9	—	—	*Aug.*
		Co. Dublin.	,,	184	5 6	5 4	18	21	21	17	19	20	21	19	18	16	14	6	105	95	10	210	54	32 10	2 3	oz	—	—	*June*
			,,	185	5 0	6 0	24	20	22	15	14	15	19	10	5	3	—	—	52	67	19	138	52	22 7¼	2 2	(c) 26 1	—	—	Aug., *June*
			,,	186	4 13	5 6	15	17	16	16	15	16	19	20	17	18	10	—	17	146	16	179	35	27 9¾	2 1	(d) £9 1 5¼	—	—	Aug , *June*
*	28	Miss L. Day,	1939 Mar. 15	157	4 10	5 4	20	18	18	14	17	18	18	18	18	19	16	10	11	103	90	204	14	29 11	2 0	(a) 1,212	—	—	Aug.
		Corcovada,	,,	158	4 10	4 8	20	21	21	19	22	23	16	17	16	15	19	9	38	159	21	218	57	33 10¼	2 2	lb oz. dr.	—	—	Oct., June
		Ballyhad,	,,	159	4 12	5 4	21	21	21	22	20	21	15	17	16	10	6	11	174	27	—	201	68	32 1¼	2 6	(b) 161 12 9	—	1	June
		Rathdrum,	,,	160	4 14	4 12	10	—	—	12	8	19	22	20	21	16	20	9	137	19	1	157	10	22 6¼	2 5	oz.	—	—	Oct.
		Co. Wicklow.	,,	161	5 2	5 10	22	22	21	20	19	20	25	24	24	20	21	10	119	123	6	248	65	38 5	2 3	(c) 25 6	—	—	*June*
			,,	162	5 6	6 6	8	—	8	23	23	25	25	22	18	14	12	6	2	41	141	184	8	24 3¼	1 15	(d) £9 1 1¼	6	2	Oct.,Aug ,*June*
12	41	Mrs. M. O. Roberts,	1939 April 12	229	5 6	6 12	—	14	17	17	17	14	18	23	12	15	7	5	74	84	1	159	36	24 10¼	2 3	(a) 1,150	—	—	Oct., *June*
		Lakemount,	Mar 12	230	5 8	6 0	20	14	16	14	13	9	9	6	6	—	—	—	30	56	21	107	32	17 2	2 2	lb oz. dr.	—	—	*June*
		Glanmire,	April 4	231	5 10	7 0	10	22	21	19	19	21	19	18	18	16	19	10	50	134	28	212	31	32 8¼	2 2	(b) 152 1 6	1	—	*June*
		Co. Cork.	Mar 12	232	5 9	6 6	23	19	19	18	20	20	24	22	23	23	22	11	48	170	26	244	43	37 0¼	2 2	oz.	—	—	June
			April 4	233	5 14	6 0	9	25	22	23	23	22	22	23	25	16	20	10	88	148	4	240	57	37 6¼	2 3	(c) 25 4	2	—	*June*
			,,	234	6 10	6 0	18	18	18	17	15	17	20	20	20	14	11	—	8	128	52	188	9	28 6	2 0	(d) £8 17 10¼	2	—	Aug., *June*
13	23	Mrs. K. Byrne,	1939 Jan.	127	5 12	7 0	23	18	3	—	—	24	25	23	20	6	19	11	9	146	17	172	35	25 8	2 1	(a) 1,152	—	1	Dec., June
		Balgaddy,	,,	128	5 0	6 10	—	—	15	23	23	21	22	21	13	19	20	8	161	24	—	185	18	27 5½	2 7	lb. oz. dr.	—	1	Oct., *Aug.*
		Clondalkin,	Feb.	129	5 5	6 10	15	21	22	20	14	18	18	12	18	11	9	7	8	147	30	185	42	29 1½	2 0	(b) 154 14 7	1	3	June
		Co. Dublin.	,,	130	4 12	6 4	11	25	21	22	21	25	24	24	25	23	23	7	156	88	2	246	60	38 3¼	2 4	oz.	—	—	Oct., *June*
			,,	131	4 13	5 8	—	—	19	21	21	24	17	19	13	15	—	—	9	137	3	149	23	22 11¼	2 1	(c) 25.8	—	2	Oct., June
			,,	132	4 12	6 0	8	25	24	23	21	21	24	24	14	21	—	10	22	153	40	215	26	33 7½	2 1	(d) £8 17 1¼	2	1	Oct., June
14	20	Mr. W. Barron,	1939 Jan. 27	109	5 4	5 8	18	16	15	16	17	9	12	10	4	—	8	—	101	24	—	125	51	20 2	2 4	(a) 1,057	—	—	*June*
		"Wood View,"	,,	110	5 14	D	22	22	21	18	18	19	21	20	16	3	—	D	109	71	—	180	70	29 0¼	2 3	lb oz. dr.	—	—	June
		Gortrush,	,,	111	6 6	7 8	21	24	18	13	—	10	22	15	13	10	13	5	148	15	1	164	67	26 2¼	2 5	(b) 152 1 4	—	—	Jan.
		Piltown,	,,	112	6 8	7 4	24	23	22	19	19	19	24	25	24	21	21	8	232	17	—	249	73	38 8¼	2 5	oz.	—	—	*June*
		Co. Kilkenny.	,,	113	6 0	6 8	19	21	20	20	17	20	14	10	9	6	7	9	116	56	—	172	64	27 9¼	2 4	(c) 27.6	—	—	*June*
			,,	114	7 3	7 8	—	—	—	14	23	21	23	21	21	19	17	8	164	3	—	167	1	24 0¼	2 7	(d) £8 5 11¼	—	—	Oct., June

*Disqualified under Clause 29 (more than 20 per cent. second grade eggs).

D = Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No of Pullet	Weight On Arrival lb oz.	Weight At close of test lb. oz	Eggs Laid Oct 1-Oct 28	Oct 29-Nov 25	Nov 26-Dec 23	Dec 24-Jan 20	Jan 21-Feb 17	Feb 18-Mar 16	Mar 17-Apl 13	Apl 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug 4-Aug 17	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr	(a) Total Eggs from Pen. (b) Total weight. (c) Av Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
15	19	Miss M. O'B-ien,	1939 Feb 5	103	6 0	8 0	9	8	—	7	8	13	17	20	12	—	—	—	72	40	2	94	15	14 0¼	2 4	(a) 1,050	—	—	Nov , June
		Moycarkey,	,,	104	4 12	5 4	24	25	21	18	20	23	22	23	16	16	13	6	128	93	6	227	74	35 11¼	2 3	lb oz dr	—	1	June
		Horse and Jockey,	,,	105	4 8	6 0	—	16	21	19	19	19	20	18	17	14	14	4	178	3	—	181	41	28 3¼	2 7	(b) 149 11 10	—	—	Oct , *June*
		Thurles,	,,	106	4 12	5 4	20	24	13	22	21	21	24	22	7	21	6	11	19	143	50	212	15	32 3¾	2 1	oz	1	1	June
		Co. Tipperary	,,	107	4 9	6 0	15	23	15	15	12	13	9	4	—	—	—	—	102	3	1	106	56	18 0¼	2 6	(c) 27 4	—	—	*May*
			,,	108	5 0	6 9	17	16	20	21	24	24	24	24	25	1	23	11	217	12	1	230	57	35 6	2 6	(d) £8 4 1	—	1	June
16	45	Mrs B McKenna,	1939 Feb 19	253	4 13	D	23	18	21	19	15	15	14	9	—	—	D	—	19	82	33	134	39	21 7½	2 1	(a) 1,056	—	—	Oct.
		Giltown,	,,	254	4 9	5 0	—	—	21	22	22	22	25	13	27	10	18	4	1	111	70	182	15	25 11	2 0	lb oz dr.	—	3	Oct , June
		Navan,	,,	255	5 0	6 12	—	9	18	14	18	18	18	21	20	14	16	8	129	44	—	173	30	26 5¾	2 4	(b) 139 11 12	—	—	Oct..Aug ,*June*
		Co. Meath.	,,	256	4 8	5 8	24	23	22	21	21	20	22	19	19	22	21	10	129	115	—	244	72	38 1¼	2 3	oz	—	—	Oct , *June*
			,,	257	4 15	5 4	21	22	21	17	10	21	19	—	3	—	—	—	4	91	39	134	30	21 9¾	2 0	(c) 25 4	1	—	Oct , June
			,,	258	4 14	5 15	—	17	24	5	23	25	23	15	17	19	12	9	48	137	4	189	44	29 5¾	2 2	(d) £8 3 4½	—	3	Oct ,Aug ,*June*
17	21	Mrs J. Fahy,	1939 Feb 12	115	4 12	5 4	26	25	23	20	22	21	23	14	16	12	8	9	17	154	48	219	33	34 0	2 0	(a) 1,044	—	3	June
		Corbally,	Mar 9	116	4 8	6 0	—	19	27	21	21	22	23	22	13	25	18	10	66	138	15	219	34	33 10	2 2	lb oz dr.	—	1	Oct ,Aug.,*June*
		Ballyglunin,	Jan 19	117	4 13	7 0	8	10	12	11	7	11	18	14	13	15	14	—	80	47	6	133	26	20 3¼	2 3	(b) 146 10 9	—	—	June
		Co Galway.	,,	118	5 1	6 8	21	25	4	—	—	21	27	26	23	19	18	9	192	1	—	193	50	20 5¼	2 8	oz	—	—	Dec.
			Mar. 1	119	5 3	6 0	21	20	2	10	21	22	18	21	18	16	18	7	187	7	—	194	43	29 8	2 7	(c) 27 0	—	—	June
			—	120	4 8	D	—	—	17	15	17	18	15	4	—	—	D	—	15	64	7	86	18	13 5½	2 2	(d) £8 0 8¾	—	—	Oct , *June*
18	46	Mr M. Burchael,	1939 Feb 19	259	6 12	7 8	16	14	20	14	13	15	14	13	13	14	16	5	123	42	2	167	54	26 2¼	2 4	(a) 1,013	—	—	*Aug.*
		Kill,	,,	260	6 0	6 8	16	19	19	19	17	17	19	16	20	16	15	7	173	30	—	203	58	31 9½	2 5	lb oz. dr.	—	—	*June*
		Co. Kildare	,,	261	5 6	D	16	17	—	12	16	18	21	16	3D	—	—	—	77	38	4	119	30	18 5¼	2 3	(b) 142 7 0	1	—	Dec
			,,	262	6 0	6 0	15	17	—	10	9	16	18	21	20	20	20	12	133	42	3	178	30	26 7¾	2 5	oz	—	—	—
			Mar. 3	263	5 2	5 14	—	21	21	18	16	18	23	24	23	21	16	9	170	39	1	210	46	32 6¼	2 4	(c) 27 0	—	—	Oct , *June*
			,,	264	5 0	4 12	21	5	—	—	2	20	25	12	13	12	19	7	12	89	35	136	18	19 0¾	2 0	(d) £7 14 9	1	—	Nov , *Aug.*
19	42	Mrs M. L -O'Gorman,	1939 Feb. 25	235	6 0	6 10	2	—	10	17	9	13	21	21	17	11	—	7	122	6	—	128	15	19 1¼	2 8	(a) 989	—	1	Oct ,Aug.,*June*
		Ballinamona House,	,,	236	5 8	6 2	24	24	23	21	22	23	26	23	21	21	23	12	15	209	39	263	57	40 1¼	2 1	lb oz dr.	—	—	*June*
		Mitchelstown,	,,	237	6 8	7 0	22	23	20	20	19	20	18	21	20	6	19	11	108	106	5	219	66	34 4	2 3	(b) 137 8 14	—	1	*June*
		Co. Cork.	,,	238	6 12	7 8	18	13	12	8	3	16	16	20	20	5	12	6	82	63	4	149	45	23 2	2 3	oz.	—	—	Jan., June
			,,	239	5 2	5 8	18	18	1	—	8	20	22	21	16	10	11	6	137	13	1	151	36	23 0	2 6	(c) 26 7	—	—	Dec.
			,,	240	6 4	D	—	13	19	7	16	21	3D	—	—	—	—	—	72	7	—	79	36	13 7¾	2 6	(d) £7 13 4¾	—	—	—

D. = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb.	Weight: On Arrival oz.	Weight: At close of test lb	Weight: At close of test oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 16	Mar 17-Apl 13	Apl. 14-May 11	May 12-June 8	June 9-July 8	July 7-Aug. 3	Aug. 4-Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s.	d.	Average Weight of Eggs per Pullet oz	dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
20	26	Mrs. E. Hillis,	1939 Jan. 28	145	5	11	5	8	22	18	22	14	20	20	26	23	19	8	10	—	127	70	5	202	60	31	7½	2	3	(a) 975	—	1	June
		Corrush,	,,	146	5	3	5	10	18	22	22	18	21	22	21	26	21	14	—	—	187	16	2	205	64	32	9½	2	5	lb oz. dr.	—	—	June
		Doohamlet,	,,	147	5	8	7	6	20	20	17	6	—	3	16	17	17	17	14	8	140	15	—	155	59	24	6	2	5	(b) 134 2 14	—	—	Feb., *June*
		Castleblayney,	,,	148	5	8	6	12	19	21	21	17	17	18	18	17	2	14	7	9	73	82	25	180	42	28	3¼	2	2	oz	—	2	June, *June*
		Co. Monaghan	,,	149	4	12	5	10	24	23	25	21	21	24	25	23	21	7	16	3	17	152	64	233	40	35	6¼	2	0	(c) 26.4	1	1	June
			,,	150	5	2	7	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—		(d) £7 12 8¼	—	—	*June*
21	44	Miss K. Newman,	1939 Feb.	247	5	0	5	0	20	22	20	20	20	20	20	23	20	5	16	—	70	117	19	206	49	32	0¾	2	2	(a) 976	—	1	Oct., June
		Drinadaly,	,,	248	5	5	6	4	20	22	23	18	21	20	22	21	21	20	21	10	45	170	24	239	46	36	10¼	2	2	lb oz. dr.	1	—	*June*
		Trim,	,,	249	5	5	D		D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—		(b) 132 4 7	—	—	—
		Co. Meath.	,,	250	4	10	4	6	22	19	21	22	19	21	22	19	9	11	13	6	87	114	3	204	64	32	2	2	3	oz.	1	1	June
			,,	251	5	6	6	15	—	21	22	22	19	22	20	16	14	18	13	5	176	15	1	192	47	30	2¾	2	5	(c) 26.0	—	—	*June*
			,,	252	4	12	5	12	—	14	19	—	13	20	19	15	10	11	8	6	42	83	10	135	26	21	2½	2	2	(d) £7 12 6¼	—	3	Oct.,Jan.,June
22	27	Mrs. E. M. J. Condron	1939 Mar.	151	4	8	5	0	—	—	15	21	21	22	23	20	15	8	18	6	30	118	15	169	10	24	10½	2	2	(a) 978	2	2	Oct., June
		Knocktemple,	,,	152	4	12	5	8	22	21	22	20	19	18	15	11	18	5	18	2	95	75	21	191	50	30	0¼	2	3	lb. oz. dr.	1	1	June
		Virginia,	,,	153	4	8	6	0	13	15	17	16	14	11	19	19	17	13	12	1	126	37	4	167	45	26	0¾	2	5	(b) 133 7 15	—	—	Aug., *June*
		Co. Cavan.	,,	154	5	5	6	7	—	—	18	20	12	17	4	2	2	1	—	6	77	5	—	82	23	13	5½	2	6	oz.	—	—	Oct., May
			,,	155	4	14	5	8	21	—	8	25	20	23	25	23	16	21	1	1	7	149	28	184	14	27	1	2	1	(c) 26 2	—	—	Oct.,Aug.,*June*
			,,	156	4	12	6	0	18	19	17	18	16	15	19	19	7	7	20	10	108	72	5	185	52	28	9¾	2	3	(d) £7 10 3¼	—	—	June
†	36	Mrs K. O'Driscoll,	1939 Feb. 26	199	5	4	8	3	—	9	19	20	20	20	25	26	25	24	19	11	59	154	5	218	29	32	10	2	3	(a) 893	—	—	Oct., *June*
		Lisloose,	Feb. 20	200	5	4	6	8	2	25	22	18	17	15	22	21	25	19	20	2	86	119	3	208	53	32	6¼	2	3	lb. oz. dr.	—	—	*June*
		Tralee,	—	201	5	0	6	8	2	19	18	16	14	19	22	23	21	22	22	10	204	3	1	208	43	32	0¼	2	6	(b) 128 0 3	—	—	Oct., *June*
		Co. Kerry.	—	202	5	0	D		2	10	D	—	—	—	—	—	—	—	—	—	—	5	7	12	5	2	2¼	1	14	oz.	—	—	—
			Feb. 8	203	5	4	5	14	7	8	16	17	19	21	20	19	16	17	15	8	178	5	—	183	34	27	11½	2	9	(c) 27.5	—	—	Oct.,Aug.,*June*
			,,	204	4	14	D		23	16	7	10	8	—	D	—	—	—	—	—	3	43	18	64	30	10	10	2	0	(d) £6 18 4¼	—	—	Feb.
†	22	Mrs. M. E. Bailey,	1939 Mar. 1	121	5	12	6	4	22	22	25	21	20	23	24	26	25	19	23	8	237	21	—	258	74	40	2¾	2	5	(a) 860	—	—	*June*
		Gortboy House,	,,	122	5	4	6	0	4	19	18	21	18	20	23	20	21	13	18	5	112	80	8	200	38	30	10¼	2	3	lb. oz. dr.	1	1	*June*
		Kilmallock,	,,	123	5	12	7	9	—	16	23	20	19	21	22	21	22	20	20	7	112	98	1	211	41	32	7¾	2	3	(b) 122 10 1	—	—	Oct., *Apl.*
		Co. Limerick.	,,	124	5	12	8	9	—	—	—	—	—	—	—	—	—	—	—	2	1	1	—	2	—	0	3¼	2	3	oz.	—	—	Oct.,Jan.,June
			,,	125	5	0	5	8	—	—	—	2	14	9	6	6	—	5	—	—	39	3	—	42	—	6	1½	2	6	(c) 27 4	—	—	Oct.,Aug.,*June*
			,,	126	5	0	5	12	2	16	15	12	14	20	19	17	14	12	5	1	140	7	—	147	33	23	1½	2	7	(d) £6 13 3¼	—	—	*June*

†Disqualified under Clause 29 (pen produced less than 960 eggs). D = Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct 29-Nov. 25	Nov. 26 Dec 23	Dec. 24-Jan. 20	Jan 21-Feb. 17	Feb 18-Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug. 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s d.	Average Weight of Eggs per Pullet oz dr	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
*†‡	31	Miss J. McDermott, Ballyhack, Ashbourne, Co. Meath.	1939 Feb. 25	175	5 0	6 2	—	—	—	3	4	9	19	7	13	18	6	11	—	4	86	90	—	10 11½	1 13	(a) 686	26	—	Oct., Aug.
			,,	176	5 0	7 8	—	—	—	1	—	—	—	—	—	—	—	1	—	1	1	2	—	0 3½	1 15	lb oz dr.	7	—	Aug, *June*
			,,	177	4 12	5 10	5	2	—	20	22	20	22	21	10	13	17	7	—	20	139	159	—	20 3½	1 14	(b) 83 10 6	26	1	Oct., *Aug.*
			,,	178	5 8	5 12	19	22	20	20	22	21	22	18	21	19	14	5	9	168	46	223	31	34 0½	2 0	oz	3	—	Aug, *June*
			,,	179	5 0	D	—	—	—	—	—	—	—	1	1	—	D	—	—	2	—	2	—	0 3½	2 1	(c) 23.4	7	—	June
			,,	180	5 5	6 0	21	20	18	19	19	21	18	20	22	18	14	—	—	130	80	210	13	31 3½	2 0	(d) £4 17 2	—	—	*June*
†	39	Mrs. J. Foley, Moyhill House, Cratloe, Co. Clare,	1939 Mar	217	4 11	D	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(a) 373	—	—	Oct.
			,,	218	5 0	3 6	—	—	—	2	18	20	17	14	14	5	—	—	19	57	14	90	—	12 9½	2 1	lb oz dr	1	—	Oct.
			,,	219	5 8	D	—	—	—	9	9	—	D	—	—	—	—	—	2	16	—	18	—	2 8½	2 3	(b) 48 11 9	—	—	Oct.
			,,	220	4 9	D	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	oz	—	—	Oct.
			,,	221	4 8	4 8	—	—	—	4	19	21	20	15	12	10	10	—	6	62	43	111	—	14 11¾	2 0	(c) 25 1	1	—	Oct.
			,,	222	5 0	5 0	8	18	17	15	17	19	18	14	13	2	6	7	50	93	11	154	43	24 4¼	2 2	(d) £2 14 10¼	1	—	*June*
†	35	Mrs. A B Barbour, Knockbeg House, Collooney, Co Sligo	1939 Feb. 6	193	5 0	D	22	6D	—	—	—	—	—	—	—	—	—	—	9	19	—	28	28	4 8¾	2 0	(a) 323	—	—	—
			Feb 28	194	4 12	4 0	20	14	9	15	3	1	—	12	10	—	—	—	2	52	30	84	37	13 5	2 0	lb oz. dr.	3	—	June
			,,	195	4 8	D	22	25	22	20	10	15	16	16	4	—	D	—	94	55	1	150	72	25 0¼	2 4	(b) 42 8 12	—	—	—
			,,	196	5 0	D	7	—	—	—	D	—	—	—	—	—	—	—	4	—	3	7	4	1 0	2 0	oz	—	—	Nov
			Feb 6	197	4 12	D	18	6	—	—	6	—	—	—	D	—	—	—	20	10	—	30	24	4 11½	2 2	(c) 25.3	—	—	Nov.
			Feb 28	198	4 14	D	5	16	—	—	D	—	—	—	—	—	—	—	1	18	5	24	19	4 4½	2 0	(d) £2 13 6	—	—	Oct.

*Disqualified under Clause 29 (more than 20 per cent second grade eggs) †Disqualified under Clause 29 (pen produced less than 960 eggs),
‡Disqualified under Clause 26 (eggs failed to reach the standard weight of 24 oz per dozen). D = Dead.

SECTION III.—RHODE ISLAND RED—15 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct 1-Oct 28	Oct 29-Nov 25	Nov 26-Dec 23	Dec 24-Jan 20	Jan 21-Feb. 17	Feb 18-Mar 16	Mar. 17-Apl 13	Apl 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec 20	Value per Pullet s d	Average Weight of Eggs per Pullet oz. dr	(a) Total Eggs from Pen (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
1	61	Mr. W. Murphy,	1939 Feb. 3	349	5 0	6 0	27	25	25	25	22	21	27	24	23	22	22	10	64	196	13	273	76	42 4½	2 2	(a) 1,413	1	—	*June*
		Skeeter Park,	Feb. 27	350	5 12	7 4	18	23	22	20	15	6	26	26	22	19	15	10	84	132	6	222	62	34 4½	2 3	lb oz. dr.	—	—	Feb., *Aug.*
		Clearlestown,	Feb. 3	351	5 12	6 14	21	—	—	13	24	21	23	24	21	19	23	9	192	5	1	198	21	28 8¼	2 2	(b) 196 9 14	—	—	Nov., *Aug.*
		Co. Wexford.	,,	352	5 12	7 6	12	8	22	20	20	23	21	26	20	26	23	11	178	50	4	232	43	35 4¼	2 4	oz	—	—	*Aug.*
			Feb. 27	353	5 3	7 3	—	—	6	23	25	26	24	28	26	25	24	9	84	127	5	216	10	31 4¾	2 3	(c) 26 7	—	—	Oct., *June*
			Feb. 3	354	5 2	6 4	26	25	24	26	21	26	26	17	25	25	21	10	118	151	3	272	79	42 6½	2 3	(d) £10 14 8¾	—	—	*Aug.*
*	62	Miss V. Burdon,	1939 Feb. 27	355	4 10	5 4	—	9	25	24	20	24	24	24	21	16	6	7	6	156	38	200	30	30 4¼	2 0	(a) 1,284	1	1	Oct., Aug.
		The Laurels,	,,	356	5 4	5 8	21	20	17	20	19	21	21	24	26	19	20	12	12	194	34	240	45	36 4¾	2 1	lb oz. dr.	—	—	—
		Buttevant,	,,	357	5 6	6 0	—	—	—	1	21	22	23	24	27	24	22	10	56	111	7	174	—	24 7¼	2 2	(b) 164 6 14	—	—	Oct., *Aug.*
		Co. Cork.	,,	358	5 0	5 6	18	22	20	20	19	20	21	16	19	17	8	—	100	93	7	200	58	31 7¾	2 2	oz.	—	—	*Aug.*
			,,	359	5 0	6 6	23	23	23	21	21	21	23	24	20	18	17	11	2	190	53	245	44	37 3½	2 0	(c) 24 6	—	—	*Aug.*
			,,	360	5 2	5 12	23	19	25	24	23	25	24	17	18	13	13	1	1	86	138	225	26	32 9	1 15	(d) £9 13 0¼	1	3	*Aug.*
2	56	Miss J. Weston,	1939 Mar.	319	5 0	6 8	15	18	17	16	17	17	20	21	19	16	19	10	180	21	4	205	49	31 9	2 5	(a) 1,260	—	—	Oct.
		Ballymadrough,	,,	320	5 6	5 12	23	20	21	20	17	24	26	23	25	22	19	10	92	121	37	250	33	38 0¾	2 2	lb oz. dr.	—	—	*June*
		Donabate,	,,	321	5 0	6 8	—	—	3	17	17	14	22	21	20	19	19	9	6	142	13	161	6	22 11	2 1	(b) 173 7 7	—	—	Oct., *June*
		Co. Dublin.	,,	322	5 6	4 12	22	17	17	13	15	20	22	23	22	10	4	—	39	116	30	185	32	28 5½	2 2	oz.	—	—	*June*
			,,	323	5 14	6 12	23	24	24	22	22	24	27	25	23	20	16	13	122	139	2	263	74	41 1	2 3	(c) 26 4	—	—	Aug., *June*
			,,	324	5 4	6 0	—	—	6	21	26	24	19	19	24	21	23	13	180	16	—	196	11	28 8¾	2 7	(d) £9 10 11	—	—	—
3	54	Mrs. M. A. Miller,	1939 Mar. 1	307	5 6	7 4	—	—	8	22	22	25	28	27	26	16	20	10	157	46	1	204	12	20 9¾	2 4	(a) 1,199	—	—	Oct.,Aug.,*June*
		Millview,	,,	308	5 15	6 4	—	—	23	22	22	22	22	24	22	15	3	9	166	17	1	184	28	28 2	2 6	lb oz. dr.	—	1	Oct., June
		Rathowen,	,,	309	5 8	D	23	22	23	21	20	19	18d	—	—	—	—	—	133	13	—	146	73	24 5	2 5	(b) 168 0 2	—	—	—
		(Co. Longford).	,,	310	5 5	6 12	15	10	20	21	20	21	23	24	25	25	19	8	106	125	—	231	50	35 3¼	2 3	oz.	—	—	Aug., *June*
			,,	311	5 2	5 12	17	23	22	23	23	23	24	16	18	12	4	4	69	135	5	209	62	33 3¾	2 3	(c) 26 9	—	2	June
			,,	312	5 5	6 0	—	—	22	20	19	22	27	28	24	26	25	12	74	151	—	225	25	33 6	2 3	(d) £9 4 5½	—	—	Oct., *Aug.*
4	59	Capt. H. M. S. Redmond,	1939 Feb.	337	5 0	5 8	23	26	22	20	15	17	26	26	23	17	18	10	164	77	2	243	71	38 0	2 4	(a) 1,236	—	—	May
		Popefield,	,,	338	6 4	7 10	20	24	1	—	17	27	27	19	—	23	8	7	164	8	1	173	44	26 8¾	2 8	lb oz. dr.	—	3	Dec.,Aug.,*June*
		Athy,	,,	339	6 6	7 12	23	9	26	23	20	22	23	23	21	1	21	7	177	39	3	219	60	33 10½	2 5	(b) 171 9 4	1	1	Nov., June
		(Laoighis).	,,	340	5 6	5 3	23	—	—	13	22	24	28	25	25	18	20	8	35	150	21	206	8	29 6¾	2 2	oz	—	—	Nov.
			,,	341	5 0	7 0	23	21	23	14	8	12	23	28	24	23	24	9	4	75	153	232	8	32 10¾	1 15	(c) 26 7	9	—	*June*
			,,	342	5 8	7 10	3	—	—	—	19	19	24	23	26	20	19	10	156	7	—	163	3	23 1¾	2 5	(d) £9 4 1¾	—	—	Oct., *Aug.*

*Disqualified under Clause 20 (more than 20 per cent. second grade eggs).

D = Dead

SECTION III.—RHODE ISLAND RED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1 Oct 28	Oct 29-Nov 25	Nov 26 Dec. 23	Dec 21-Jan 20	Jan 21-Feb 17	Feb. 18-Mar 16	Mar 17-Apl 13	Apl 14-May 11	May 12-June 8	June 9 July 6	July 7-Aug 3	Aug. 4 Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec. 29	Value per Pullet (s d)	Average Weight of Eggs per Pullet (oz. dr)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
5	50	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	1939 Feb.-Mar.	283	4 12	5 0	16	16	10	17	15	18	21	24	23	21	20	9	102	105	3	210	43	31 11½	2 3	(a) 1,183	—	—	—
			,,	284	4 12	5 8	12	21	6	—	15	19	25	25	24	12	21	9	159	30	—	189	30	28 9½	2 5	lb. oz dr.	—	—	Oct, *June*
			,,	285	4 13	5 8	—	—	15	25	26	26	28	27	26	26	24	11	4	161	69	234	17	33 1	2 0	(b) 158 1 15	2	—	Oct, *Aug.*
			,,	286	5 0	5 6	—	15	21	17	18	19	22	23	27	27	22	9	46	168	6	220	37	33 6¼	2 2	oz	—	—	Oct, *Aug.*
			,,	287	6 0	4 12	24	23	22	23	21	25	27	22	15	—	—	—	7	144	51	202	31	31 5½	2 0	(c) 25 7	—	—	Aug.
			,,	288	5 2	5 8	—	—	18	15	23	26	28	18	—	—	—	—	82	46	—	128	19	19 6¼	2 4	(d) £8 18 4½	—	—	Oct, Aug, *June*
6	48	Mrs. K. Cuddihy, Glenmore, Co. Kilkenny.	1939 Feb. 21	271	5 10	6 4	14	1	23	23	13	23	28	28	24	21	21	8	180	45	2	227	42	34 1¼	2 4	(a) 1,197	—	—	Nov, *Aug.*
			,,	272	5 14	D	—	—	12	17	16	20	22	24	22	13	11	D	56	99	2	157	14	23 3¼	2 3	lb oz dr	—	—	Oct, *June*
			,,	273	5 14	5 10	23	20	20	19	18	21	25	22	20	19	13	3	22	162	39	223	31	34 0¾	2 1	(b) 157 9 6	—	—	*June*
			,,	274	5 4	6 12	—	3	21	21	18	21	25	25	25	22	24	11	6	181	29	216	28	31 9¼	2 1	oz.	—	—	Oct.
			,,	275	5 6	6 14	7	20	21	20	17	15	22	17	19	18	16	5	18	141	38	197	50	30 1¾	2 1	(c) 25 3	2	—	—
			,,	276	5 10	6 8	11	—	—	3	21	24	24	24	23	21	17	9	1	143	33	177	5	24 8	2 0	(d) £8 18 0	—	—	Nov.
*	51	Mrs. C. L. Cardew, Castlefogarty, Thurles, Co. Tipperary.	1939 Feb 28	289	5 8	7 2	21	12	—	23	18	22	23	18	22	16	14	10	133	54	12	199	26	29 8	2 4	(a) 1,182	—	—	Nov, Aug, *June*
			,,	290	5 8	6 0	24	21	24	25	24	24	24	20	—	14	7	11	10	155	53	218	35	33 7¼	2 1	lb oz dr.	—	2	June
			,,	291	4 12	6 0	22	23	22	22	20	21	21	20	8	17	4	8	23	142	43	208	37	32 4½	2 1	(b) 151 2 4	—	—	June
			,,	292	4 8	5 0	24	24	24	23	25	23	23	18	15	10	6	7	2	86	134	222	9	32 8	1 15	oz	—	3	June
			,,	293	4 12	5 8	3	—	7	—	3	21	22	8	20	11	—	11	5	86	15	106	5	15 6¼	2 1	(c) 24 6	—	2	June
			,,	294	5 6	5 12	22	21	21	20	20	25	25	21	23	20	11	—	5	125	99	229	16	33 11¼	2 0	(d) £8 17 10	—	—	July
*	57	Major R. E. Barrow, Milestown, Castlebellingham, Co Louth.	1939 Jan.	325	5 3	5 8	21	23	23	21	21	20	15	16	13	15	17	5	9	168	31	208	66	32 6	2 1	(a) 1,172	—	—	*June*
			,,	326	5 0	5 8	23	14	—	5	22	24	27	28	27	20	23	10	1	40	182	223	7	29 1½	1 14	lb oz dr	1	—	Nov.
			,,	327	5 2	D	24	20	18	19	18	21	22	23	19	—	D	—	57	117	10	184	62	29 2¼	2 2	(b) 153 8 8	—	—	Nov, *June*
			,,	328	5 0	5 4	—	—	19	16	22	23	25	26	23	22	22	10	3	115	90	208	12	28 11¼	2 0	oz	1	—	Oct
			,,	329	4 8	5 8	—	—	—	—	—	20	23	24	23	19	21	9	50	83	6	139	—	19 6	2 3	(c) 25 2	—	—	Oct
			,,	330	4 8	5 14	2	23	25	23	24	19	20	20	16	14	17	7	198	12	—	210	55	33 1¼	2 6	(d) £8 12 5½	—	—	Oct., *June*
7	52	Mrs. D. C Chearnley, Salterbridge P. F., Ballynadygne, Lismore, Co. Waterford.	1939 April 10	295	4 8	5 10	—	6	26	24	22	25	26	27	23	9	18	—	80	125	1	206	36	31 7	2 3	(a) 1,115	—	1	Oct, June
			,,	296	5 4	8 6	—	—	18	22	22	11	23	18	18	9	2	—	35	99	9	143	17	21 7	2 2	lb oz dr	—	1	Oct, June
			,,	297	4 12	6 4	—	6	5	27	24	25	19	21	12	14	14	8	130	44	1	175	17	26 2½	2 5	(b) 149 13 5	1	2	Oct, July
			,,	298	5 0	6 4	—	23	21	20	24	23	26	25	23	22	21	13	7	180	54	241	14	36 0½	2 0	oz	—	—	Oct., *June*
			,,	299	5 0	6 4	—	—	17	22	21	23	23	22	10	13	18	2	50	107	14	171	10	25 4¼	2 2	(c) 25 8	—	2	Oct, June
			,,	300	4 8	5 12	—	8	24	21	22	24	20	23	20	6	11	—	53	122	4	179	34	27 9½	2 2	(d) £8 8 6¾	—	2	Oct, June

*Disqualified under Clause 29 (more than 20 per cent second grade eggs). D = Dead.

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18—Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug. 3	Aug. 4-Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 20	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
8	55	Miss C. Mealiff,	1939 Mar 15	313	5 8	6 0	22	19	21	13	—	17	26	27	23	18	17	10	69	135	9	213	59	33 0¼	2 2	(a) 1,102	—	—	Oct., Feb.
		Ballinamona House,	,,	314	5 8	7 0	—	—	9	21	20	22	24	25	22	20	14	—	176	1	—	177	13	26 1¾	2 9	lb oz. dr.	—	—	Oct., Aug.
		Tullamore,	,,	315	5 2	5 14	—	—	19	24	25	23	25	25	25	9	18	—	165	25	3	193	22	28 10¼	2 5	(b) 164 5 15	—	2	Oct., Aug.
		Offaly	,,	316	5 0	6 0	—	1	18	—	6	17	15	17	8	11	9	6	93	15	—	108	19	16 6¼	2 5	oz.	—	—	Oct.
			,,	317	5 4	6 0	6	6	21	18	16	17	24	25	26	19	18	6	201	1	—	202	38	30 7¾	2 7	(c) 28.6	—	—	Oct., *Aug.*
			,,	318	5 0	6 6	—	21	23	22	21	21	23	22	21	15	15	5	202	7	—	209	49	32 8¼	2 8	(d) £8 7 10	—	—	Oct., *June*
9	58	Mrs. L. Hayes,	1939 Feb. 22	331	5 14	7 8	4	—	1	18	20	19	20	24	21	19	21	9	50	117	9	176	5	25 2¾	2 2	(a) 1,129	—	—	Oct., *June*
		Walshestown,	,,	332	5 0	7 4	—	—	—	3	23	20	26	28	25	23	21	11	13	149	18	180	—	27 1¾	2 1	lb. oz. dr.	—	—	Oct., *June*
		Castlemahon,	,,	333	5 6	7 2	13	—	—	11	23	25	23	26	24	23	21	9	114	83	1	198	12	26 6¾	2 4	(b) 151 0 2	—	—	Nov., *June*
		Newcastle West,	,,	334	6 0	7 4	—	2	21	21	18	19	23	20	21	16	17	7	164	19	2	185	27	27 11	2 6	oz.	—	—	Oct., *June*
		Co. Limerick.	,,	335	5 0	6 0	—	—	20	24	23	24	22	27	28	22	23	10	5	129	89	223	7	31 5¼	2 0	(c) 25.7	1	—	Oct., *June*
			,,	336	5 0	6 4	1	17	6	—	16	19	19	14	24	22	19	10	5	142	20	167	14	24 9¼	2 1	(d) £8 3 0¾	2	—	Jan., *June*
10	49	Mrs. M. F. Smith,	1939 Feb -Mar	277	4 10	5 12	16	21	22	18	19	21	18	9	3	—	5	—	84	62	6	152	58	24 9¼	2 3	(a) 1,064	1	—	June
		Bridge House,	,,	278	4 8	5 0	19	13	21	18	12	21	19	15	9	5	10	—	24	118	20	162	43	25 5¼	2 1	lb. oz. dr.	—	3	June
		Bettystown,	,,	279	5 12	7 2	18	4	2	23	19	22	23	22	20	18	14	7	189	3	—	192	28	28 6¾	2 7	(b) 148 15 7	—	—	Nov., *June*
		Co. Meath.	,,	280	4 13	6 8	5	13	17	15	18	18	23	27	26	22	20	9	191	19	3	213	40	32 4	2 5	oz.	1	—	*June*
			,,	281	4 9	7 4	—	—	7	19	21	17	16	16	16	13	5	5	131	4	—	135	12	20 1½	2 7	(c) 26.9	—	—	Oct., *June*
			,,	282	4 8	4 0	23	20	21	20	20	20	21	19	19	20	7	—	2	131	77	210	18	31 7¾	2 0	(d) £8 2 9½	—	—	June
†	53	Mr. M. Fitzgibbon,	1939 Mar. 17	301	6 4	6 14	8	—	3	20	23	24	22	24	12	15	11	10	14	140	18	172	12	24 10¾	2 1	(a) 914	1	—	Oct., *June*
		Gurrane,	,,	302	5 8	6 4	20	21	4	10	16	20	26	24	17	11	7	—	9	144	23	176	30	26 8½	2 1	lb. oz. dr.	—	—	Dec., June
		Kilmeedy,	Mar. 7	303	5 4	5 8	17	25	20	18	18	22	23	23	22	17	17	8	112	112	6	230	59	36 0½	2 3	(b) 120 5 9	—	—	*June*
		Co. Limerick.	,,	304	6 4	D	10	4	—	—	2	4D	—	—	—	—	—	—	2	16	2	20	12	3 3	2 1	oz.	—	—	Nov.
			Mar. 17	305	5 12	6 12	—	4	22	14	—	25	27	26	27	4	20	6	14	138	23	175	23	26 1½	2 1	(c) 25.3	—	2	Oct., June
			,,	306	5 8	5 4	14	—	6	16	13	18	22	21	12	18	1	—	34	100	7	141	18	20 10	2 2	(d) £6 17 10	—	2	Oct., Aug., *June*
*†	63	Rev. Bro. Dominick,	1939 Mar.	361	4 8	D	—	—	—	—	14	18	25	21	15	5	10	5D	108	3	2	113	—	16 0½	2 7	(a) 876	—	2	Oct., June
		Agricultural College,	,,	362	5 0	5 12	12	25	19	19	20	20	20	20	16	14	17	5	3	79	125	207	39	29 11½	1 15	lb. oz. dr.	1	—	*June*
		Mountbellew,	,,	363	4 8	5 2	—	23	24	23	23	25	23	24	17	22	16	2	5	162	55	222	42	33 8	2 0	(b) 114 1 4	—	1	Oct., Aug.
		Co. Galway.	,,	364	4 8	D	—	—	—	1	20	24	19	5	—	—	D	—	24	44	1	69	—	10 0	2 3	oz.	—	—	Oct., May
			,,	365	4 12	D	1	20	23	21	20	23	23	27	25	16	11	D	18	183	9	210	46	32 8½	2 2	(c) 25 0	—	—	Oct., *June*
			,,	366	4 6	D	8	—	—	7	4	6	12	7	3	8	D	—	10	38	7	55	3	8 0	2 1	(d) £6 10 4½	—	—	Oct., Feb., June *June*

*Disqualified under Clause 29 (more than 20 per cent. second grade eggs). †Disqualified under Clause 29 (pen produced less than 960 eggs). D=Dead.

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—18 PENS

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct 1-Oct 28	Oct 29-Nov. 25	Nov 26-Dec. 23	Dec. 24-Jan 20	Jan 21-Feb. 17	Feb 18-Mar. 16	Mar 17-Apl. 13	Apl 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug 4-Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
1	81	Mrs. M. O'Grady,	1939 Feb. 6	469	5 8	5 8	26	25	26	24	24	25	27	27	26	23	24	12	50	235	4	280	83	44 11¾	2 2	(a) 1,315	—	—	*June*
		Islandeady,	,,	470	5 6	5 14	21	16	16	—	11	23	26	27	26	17	19	9	57	140	14	211	52	31 11¼	2 2	lb. oz dr	—	—	Jan., *Aug.*
		Castlebar,	,,	471	4 8	5 0	24	25	21	22	22	22	26	16	21	21	4	12	138	93	5	236	75	37 3¼	2 3	(b) 178 15 7	—	1	Aug.
		Co. Mayo.	,,	472	5 4	6 2	—	—	17	24	22	24	25	23	24	22	18	6	28	170	7	205	19	30 5	2 2	oz	1	—	*Nov.*
			,,	473	4 10	5 6	23	18	19	18	1	18	24	24	22	19	7	9	69	126	7	202	63	31 7	2 2	(c) 25 5	—	1	Feb., Aug.
			,,	474	4 8	5 0	21	22	20	21	19	20	22	17	23	17	—	—	22	156	24	202	62	31 9¼	2 1	(d) £10 7 11½	—	—	*Aug.*
2	77	Capt. H. M. S. Redmond,	1939 Feb.	445	4 12	5 8	27	24	26	24	24	25	28	27	26	20	20	13	6	231	47	284	49	43 3¼	2 0	(a) 1,368	—	—	*June*
		Popefield,	,,	446	4 12	6 10	4	—	11	20	18	18	23	22	22	19	17	9	63	119	1	183	18	26 10¼	2 3	lb. oz dr.	1	—	Oct, *June*
		Athy,	,,	447	5 4	6 10	12	24	21	24	20	23	22	21	24	23	18	9	120	117	4	241	59	37 7¾	2 3	(b) 180 3 8	3	—	Aug. *June*
		(Laoighis).	,,	448	5 14	7 14	22	24	21	18	20	18	20	22	22	12	18	2	42	169	8	219	66	34 4	2 2	oz	—	—	June
			,,	449	5 6	7 0	19	20	20	20	16	13	22	23	16	16	20	10	124	88	3	215	62	33 4½	2 3	(c) 25 3	—	—	*June*
			,,	450	4 12	5 2	2	2	24	24	23	22	24	24	27	21	21	12	—	114	112	226	19	31 9¾	1 15	(d) £10 7 4	1	—	Oct.
3	68	Miss M. O'Donovan.	1939 Feb.	391	5 5	5 10	—	—	21	22	21	23	27	28	27	22	21	11	75	147	1	223	26	33 3¼	2 3	(a) 1,344	—	—	Oct, *June*
		Dromore,	Mar.	392	5 12	6 0	20	20	21	19	20	21	23	19	18	15	17	10	171	50	2	223	64	34 8¾	2 5	lb. oz. dr	—	—	*June*
		Villierstown,	,,	393	5 6	5 8	22	21	19	21	19	19	24	26	17	16	15	9	83	140	5	228	62	35 5¾	2 3	(b) 183 13 7	—	—	June, *Aug.*
		Cappoquin,	,,	394	5 5	5 12	20	22	18	15	17	21	26	25	25	20	20	10	97	136	6	239	59	36 10	2 3	oz.	—	—	July
		Co. Waterford.	,,	395	5 4	5 6	20	2	20	19	18	20	21	22	20	19	21	10	54	141	17	212	31	31 9¼	2 2	(c) 26 3	—	—	Nov., *June*
			,,	396	5 4	5 12	13	20	19	20	18	21	23	23	23	16	15	8	98	116	5	219	51	34 1	2 3	(d) £10 6 2	—	—	Oct., *June*
*	82	Mrs. E. M. O'Flynn,	1939 Feb. 27	475	4 12	5 15	10	21	5	20	19	20	25	24	23	22	18	11	—	77	141	218	26	30 3½	1 15	(a) 1,355	4	—	June
		Prohurst House,	,,	476	5 0	5 10	17	8	—	15	22	23	24	23	26	23	20	10	12	156	43	211	24	30 2¼	2 1	lb. oz. dr.	—	—	*Aug.*
		Milford,	,,	477	4 12	5 8	19	24	20	21	21	22	26	28	22	23	22	12	34	215	11	260	64	40 0¾	2 2	(b) 171 11 0	—	1	*Aug.*
		Charleville,	,,	478	5 6	6 8	15	24	21	18	20	20	24	25	26	7	24	9	23	193	17	233	60	36 1	2 1	oz	1	1	June
		Co. Cork	,,	470	5 12	6 0	16	20	24	21	23	21	26	19	12	14	12	2	47	151	12	210	60	32 10	2 2	(c) 24 3	—	4	Aug.
			,,	480	5 0	4 14	19	22	22	19	21	20	24	25	24	9	18	—	2	74	147	223	14	31 11¼	1 15	(d) £10 1 4¾	1	2	June
4	76	Miss J. Weston,	1939 March	439	5 12	6 4	20	17	15	15	16	18	19	21	19	18	17	11	164	39	3	206	53	31 8¾	2 4	(a) 1,302	—	—	*June*
		Ballymadrough,	,,	440	6 8	6 8	15	22	17	21	15	15	20	2	9	4	—	9	141	8	—	149	58	24 3¼	2 6	lb. oz. dr.	—	—	June
		Donabate,	,,	441	5 0	5 4	23	20	20	20	2	10	22	20	20	19	14	10	57	125	18	200	54	30 11¾	2 2	(b) 175 13 0	—	—	Feb, *Aug.*
		Co. Dublin.	,,	442	5 4	5 14	11	23	18	18	19	24	27	22	22	21	24	10	113	122	4	239	52	36 11	2 3	oz.	—	—	*June*
			,,	443	5 2	5 2	23	21	20	19	19	23	24	23	18	21	16	—	13	171	43	227	35	34 0¾	2 1	(c) 25.9	—	—	Aug.
			,,	444	5 2	5 14	25	22	28	26	25	22	27	24	27	20	22	13	36	201	44	281	44	42 10¼	2 1	(d) £10 1 3¾	1	—	*Aug.*

*Disqualified under Clause 29 (more than 20 per cent. second grade eggs).

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18—Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug. 3	Aug. 4-Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s. d	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
5	67	Mrs. M. F. Smith,	1939 Feb.-Mar.	385	4 14	5 6	14	21	15	20	20	22	26	26	26	21	22	11	215	29	—	244	55	37 6	2 5	(a) 1,266	—	—	*Nov.*
		Bridge House,	,,	386	5 0	4 0	21	16	21	18	18	20	22	21	20	14	7	—	140	55	3	198	60	31 1¼	2 4	lb. oz. dr.	—	—	Aug.
		Bettystown,	,,	387	5 4	7 0	19	21	23	21	21	21	21	8	—	10	7	4	98	75	3	176	65	28 4¼	2 3	(b) 180 12 13	—	—	May
		Co. Meath.	,,	388	5 0	7 0	—	2	20	16	21	21	22	20	18	13	9	5	166	1	—	167	25	25 5¾	2 7	oz.	—	—	July
			,,	389	5 0	5 8	18	16	18	18	19	19	22	22	24	23	19	11	184	43	2	229	56	35 2¼	2 5	(c) 27 4	1	—	*June*
			,,	390	5 0	5 14	22	20	20	22	19	21	26	25	23	24	19	11	134	112	6	252	66	38 10	2 3	(d) £9 16 5½	2	—	Aug.
6	65	Mr. R. M. Burke,	1939 Feb. 21	373	5 2	D	—	—	10	27	24	27	24	28	24	23	2	D	65	122	2	189	15	28 2¾	2 3	(a) 1,250	—	—	Oct., Aug.
		Toghermore P.F.,	,,	374	4 12	5 12	22	23	23	21	21	23	25	24	24	22	20	10	161	84	13	258	60	40 0¼	2 4	lb. oz. dr.	—	—	—
		Tuam,	,,	375	5 3	6 0	23	23	20	18	14	17	22	12	25	6	20	13	56	148	9	213	69	33 2¾	2 2	(b) 169 10 5	—	2	June
		Co. Galway.	Mar. 1	376	4 8	5 12	17	4	—	—	18	21	23	25	25	21	24	9	142	45	—	187	21	27 1	2 4	oz.	—	—	Nov.
			,,	377	4 8	5 0	21	23	22	21	21	22	24	25	11	20	8	9	8	158	61	227	39	34 6¾	2 0	(c) 26 1	—	1	Aug.
			Feb. 21	378	5 0	6 0	11	15	18	11	4	15	17	19	17	22	18	9	97	74	5	176	46	27 3¼	2 2	(d) £9 10 4¼	—	—	*Aug.*
*	64	Mrs. J. McCarthy,	1939 Feb. 18	367	5 4	5 8	19	17	21	11	5	20	23	25	26	20	22	12	2	95	124	221	20	31 6¼	1 15	(a) 1,268	—	—	Jan., Aug., *June*
		Caherelly Castle,	,,	368	5 10	5 12	19	19	3	5	21	21	26	26	26	19	18	9	194	16	2	212	40	31 9	2 6	lb. oz. dr.	—	—	Dec.
		Grange,	,,	369	5 8	6 3	—	4	21	16	18	20	23	26	20	15	9	6	118	58	2	178	28	27 1¼	2 4	(b) 170 8 2	—	2	Oct., Aug., *June*
		Kilmallock,	,,	370	4 14	5 14	24	22	20	23	20	23	21	23	18	6	—	—	—	20	180	200	10	28 4	1 14	oz	5	—	June
		Co. Limerick.	,,	371	5 8	6 8	22	8	19	18	18	18	20	23	22	19	21	9	171	43	3	217	53	33 0¼	2 4	(c) 25.8	—	—	*Aug.*
			,,	372	5 4	5 12	21	22	23	22	22	22	28	25	23	9	15	8	121	117	2	240	69	37 6¼	2 3	(d) £9 9 4¼	—	—	June
*	71	Mrs. M. O'Reilly,	1939 Mar. 3	403	5 0	6 0	22	21	22	20	15	20	13	4	3	1	1	2	92	49	3	144	69	23 10¼	2 3	(a) 1,227	—	—	*June*
		St. Johnsfort,	,,	404	4 14	6 6	21	17	21	20	22	20	23	23	18	17	15	8	34	172	19	225	54	34 8½	2 1	lb. oz. dr.	—	2	June
		Ardee,	,,	405	4 8	5 7	15	20	19	17	16	14	22	23	10	12	12	6	135	49	2	186	57	29 2¾	2 4	(b) 157 5 15	—	2	June
		(Co Meath).	,,	406	4 11	5 8	24	20	17	23	20	14	18	13	12	16	5	9	—	41	150	191	3	27 2½	1 14	oz.	2	—	Oct., Aug., *June*
			,,	407	5 2	4 14	22	20	23	22	21	27	26	26	16	9	23	—	13	180	42	235	58	35 8¼	2 1	(c) 24.6	1	3	Oct., June
			,,	408	5 2	5 12	21	18	20	20	20	23	24	26	21	20	22	11	—	93	153	246	39	34 8½	1 15	(d) £9 5 5¼	—	—	June
7	72	Mrs. H. M. Langrell,	1939 Feb.	415	5 8	6 4	12	24	18	10	—	20	23	23	24	15	19	6	72	118	4	194	55	30 2¼	2 2	(a) 1,202	—	1	Jan., *June*
		Killinure,	,,	416	4 14	5 8	1	22	24	22	20	22	20	17	15	19	15	4	12	160	29	201	38	31 1½	2 1	lb. oz. dr.	—	1	July
		Tullow,	,,	417	4 8	5 12	6	21	20	21	20	21	24	23	23	24	22	10	5	215	15	235	48	36 0½	2 1	(b) 154 10 12	—	—	—
		(Co. Wicklow).	,,	418	5 4	6 2	19	16	—	—	21	22	22	16	21	12	1	7	1	46	110	157	2	21 7¾	1 15	oz.	1	1	Dec., July
			,,	419	4 13	6 4	—	—	—	—	19	21	23	27	20	24	21	11	6	140	20	166	—	23 2¼	2 1	(c) 24.7	—	1	Oct., July
			,,	420	5 0	6 6	17	24	23	22	22	20	24	22	20	23	20	12	13	218	18	249	61	38 6½	2 1	(d) £9 0 8½	—	—	—

*Disqualified under Clause 29 (more than 20 per cent. second grade eggs). D.=Dead

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1 Oct. 28	Oct 29-Nov 25	Nov 26 Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar 16	Mar. 17-Apl 13	Apl 14-May 11	May 12 June 8	June 9 July 6	July 7-Aug. 3	Aug 4 Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec. 29	Value per Pullet (s d)	Average Weight of Eggs per Pullet (oz dr)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
8	73	Mrs. C. Healy,	1939 Feb. 22	421	5 12	5 8	24	20	20	20	15	19	18	19	16	10	4	—	132	51	2	185	70	29 8¼	2 4	(a) 1,136	—	1	*June*
		Bweeng P.O	,,	422	5 10	7 4	19	20	19	18	15	15	20	21	22	17	15	4	59	125	21	205	40	31 8½	2 2	lb oz dr.	—	—	—
		Mallow,	,,	423	6 0	7 6	20	24	13	—	—	—	—	—	—	2	4	—	12	44	7	63	50	11 5	2 1	(b) 155 1 8	—	—	Jan, *June*
		Co. Cork.	,,	424	5 12	6 9	1	18	22	21	20	24	25	22	19	22	13	—	97	105	5	207	42	32 1¾	2 3	oz	2	—	Aug., *June*
			,,	425	6 6	7 6	15	17	21	21	21	23	24	26	23	23	20	11	166	69	10	245	48	37 6¼	2 3	(c) 26 2	—	—	Oct.
			,,	426	7 0	7 15	20	23	25	21	19	22	24	27	12	11	15	12	105	109	17	231	58	36 1½	2 3	(d) £8 18 7¼	1	2	July
9	80	Mr. W. Murphy,	1939 Feb. 3	463	4 10	D	6	—	11	16	19	24	6	9	D	—	—	—	—	50	41	91	12	13 4	1 15	(a) 1,168	3	—	Oct., April
		Skeeter Park,	,,	464	5 4	5 12	17	21	21	24	21	23	23	24	23	19	6	9	25	194	12	231	55	36 1¾	2 2	lb. oz. dr.	—	1	Aug.
		Cleariestown,	Feb. 27	465	5 1	7 6	—	7	24	22	22	23	26	21	20	16	18	10	78	131	—	209	36	31 11½	2 3	(b) 153 12 7	—	—	Oct., *June*
		Co. Wexford.	Feb. 3	466	4 8	5 0	16	3	24	19	21	26	23	22	—	—	13	12	1	112	66	179	30	26 2¾	2 0	oz	1	2	Nov., June
			,,	467	4 13	5 9	8	22	22	21	20	24	25	23	26	22	11	—	135	87	2	224	56	35 2½	2 3	(c) 25 3	—	—	June
			Feb 27	468	5 0	6 0	14	12	19	21	24	22	27	26	20	21	18	10	50	175	9	234	46	35 6	2 2	(a) £8 18 4¼	—	—	Oct
10	74	Mrs. E. O'Donnell,	1939 March	427	5 10	6 12	—	—	22	21	20	16	22	23	23	21	17	6	140	51	—	191	26	28 8½	2 5	(a) 1,162	—	—	Oct., June
		Kilbreedy West,	,,	428	5 0	6 0	17	20	19	19	20	19	25	22	20	20	17	7	94	124	7	225	60	34 9½	2 3	lb. oz dr	—	—	*June*
		Kilmallock,	,,	429	5 4	5 8	—	5	19	22	21	25	26	27	24	16	13	9	95	109	3	207	9	31 4	2 3	(b) 160 12 6	—	—	Oct., June
		Co. Limerick.	,,	430	5 12	5 8	—	—	—	20	21	26	23	17	13	9	12	—	74	63	7	144	1	20 9¼	2 3	oz.	—	4	Oct., June
			,,	431	5 0	5 8	21	21	20	18	18	20	24	25	15	13	11	1	108	95	4	207	64	32 6¼	2 3	(c) 26 6	—	—	*June*
			,,	432	6 12	7 2	19	17	6	7	18	18	23	23	22	17	12	6	119	68	1	188	42	28 7¼	2 4	(d) £8 16 9	—	—	*June*
11	75	Miss C. Mealiff,	1939 Mar. 15	433	5 8	6 6	14	15	16	15	13	17	23	21	22	19	4	—	163	16	—	179	49	27 10½	2 5	(a) 1,117	—	—	*June*
		Ballimamona House,	,,	434	5 0	5 12	23	15	11	24	22	21	23	12	19	17	13	6	71	110	25	206	30	31 2½	2 2	lb oz. dr.	1	4	Aug., *June*
		Tullamore,	,,	435	5 4	6 0	3	14	22	20	22	22	23	21	24	18	20	6	198	19	1	218	41	33 6½	2 5	(b) 156 11 9	—	—	Oct, *Aug.*
		Offaly.	,,	436	4 12	4 15	13	19	19	15	19	22	24	23	10	—	17	1	5	117	60	182	23	27 2	2 0	oz.	—	2	June
			,,	437	5 3	6 14	—	—	—	5	18	18	22	21	20	18	13	1	135	1	—	136	—	19 4¾	2 10	(c) 26.9	—	—	Oct., *Aug.*
			,,	438	5 2	5 10	24	26	12	—	20	25	26	16	21	19	7	—	99	92	5	196	58	30 8	2 3	(d) £8 9 10¼	—	2	Jan., Aug., *June*
12	69	Mrs. S. Kelly,	1939 Mar. 12	397	5 4	6 8	3	2	20	22	19	19	22	23	24	16	11	2	35	130	18	183	27	27 6¼	2 2	(a) 1,067	1	1	Aug.
		Pollerton,	Mar. 19	398	5 4	7 6	2	14	20	19	21	16	25	24	12	3	—	—	138	18	—	156	41	24 9¼	2 5	lb oz dr.	1	—	Oct, *June*
		Carlow.	Mar. 12	399	4 12	6 0	12	12	8	—	19	22	23	24	6	—	—	—	8	103	15	126	21	19 5¼	2 1	(b) 143 4 3	—	—	Oct., Dec, June
			,,	400	5 8	6 0	—	20	23	21	22	23	24	22	18	2	14	6	150	44	1	195	47	30 7¾	2 5	oz.	—	—	Aug.
			Mar 19	401	4 12	6 8	5	26	22	21	20	22	22	19	7	6	2	—	15	134	23	172	37	27 6¼	2 1	(c) 25 8	1	—	*June*
			,,	402	4 11	5 12	12	19	21	19	19	18	23	25	24	22	21	12	9	146	80	235	44	34 8½	2 0	(d) £8 4 7¼	—	—	*June*

D—Dead

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of test lb. oz	Eggs Laid: Oct. 1-Oct 28	Oct. 29-Nov. 25	Nov. 20-Dec. 23	Dec. 24-Jan. 20	Jan 21-Feb. 17	Feb. 18-Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug. 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
13	79	Miss K. Cannon, Ballyedmonduff, Sandford, Co. Dublin.	1939 Feb.	457	4 12	6 0	7	19	19	19	19	18	18	15	16	6	—	7	78	80	5	163	44	25 11¼	2 3	(a) 1,046	—	—	June
			,,	458	5 4	6 0	7	17	21	19	20	21	23	22	22	13	7	6	182	16	—	198	49	31 1½	2 5	lb oz. dr.	—	1	Aug.
			,,	459	4 12	6 0	11	10	21	21	20	22	23	23	24	14	14	6	—	95	114	209	13	29 9¼	1 15	(b) 143 11 5	—	—	Nov., *June*
			,,	460	4 11	5 12	—	3	18	19	19	20	23	25	20	19	18	8	148	44	—	192	25	28 10¼	2 4	oz	—	—	Oct., *June*
			,,	461	4 12	5 14	13	13	10	5	14	9	20	13	11	—	11	10	122	7	—	129	38	19 9¼	2 7	(c) 26 4	—	—	June
			,,	462	5 10	4 12	12	—	17	23	22	20	22	23	16	—	—	—	47	103	5	155	28	23 8¼	2 3	(d) £7 19 2¼	—	—	Nov.
*	66	Mrs. M. Cruite, Tulla, Three Castles, Co. Kilkenny.	1939 Feb.	379	4 10	5 0	17	18	17	21	2	—	23	21	21	7	13	7	3	19	145	167	6	23 3	1 14	(a) 961	25	—	—
			,,	380	5 6	6 0	—	14	20	21	19	22	25	28	25	21	23	11	56	170	3	229	36	34 10	2 2	lb. oz. dr.	—	—	Oct., *Aug.*
			,,	381	4 10	D	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(b) 126 12 11	—	—	Oct.
			,,	382	4 11	4 8	20	22	21	19	19	18	13	8	11	6	—	—	16	88	53	157	23	24 8¾	2 0	oz.	—	—	June
			,,	383	4 8	5 14	8	21	23	19	20	23	22	19	20	21	18	5	155	63	1	219	55	34 4	2 4	(c) 25 3	—	—	*June*
			,,	384	4 13	6 0	—	17	17	18	17	20	21	13	19	19	20	8	122	66	1	189	37	29 1½	2 4	(d) £7 6 3¼	—	—	*July*
*	78	Mrs. N. Barry, Ballyarthur House, Fermoy, Co. Cork.	1939 Mar. 13	451	6 10	6 12	17	6	—	—	9	23	27	28	24	24	22	12	165	26	1	192	22	27 10½	2 5	(a) 964	—	—	Nov.
			,,	452	5 14	6 0	10	16	—	20	18	19	20	22	23	20	20	8	187	9	—	196	29	29 5½	2 6	lb. oz. dr.	—	—	Dec.
			,,	453	6 10	6 8	—	—	—	—	11	12	20	23	19	18	18	9	123	6	1	130	—	18 3½	2 6	(b) 129 9 12	—	—	Nov., Aug.
			,,	454	5 4	6 4	20	22	23	21	19	15	21	17	16	14	11	6	1	101	103	205	5	30 4½	1 15	oz.	7	—	Aug., *June*
			,,	455	5 6	5 12	—	—	12	22	21	14	6	8	18	15	12	—	—	15	113	128	9	17 0¾	1 13	(c) 25 8	55	—	Oct.
			,,	456	5 4	6 3	20	18	17	—	—	—	—	10	12	14	19	3	10	57	46	113	45	17 4½	2 0	(d) £7 0 4¾	4	—	Jan.

*Disqualified under Clause 29 (more than 20 per cent second grade eggs) D = Dead

SECTION V.—ANY NON-SITTING BREED—17 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct 1-Oct 28	Oct 29-Nov 25	Nov 26-Dec 21	Dec 24-Jan 20	Jan 21-Feb 17	Feb 18-Mar 16	Mar. 17-Apl. 13	Apl 14-May 11	May 12—June 8	June 9-July 6	July 7-Aug 3	Aug 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s d	Average Weight of Eggs per Pullet oz dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	84	*White Leghorn.* Mrs. M. O'Shea,	1939 Feb. 1	487	4 0	4 15	20	14	6	5	22	17	20	17	23	17	13	6	111	68	1	180	40	27 3½	2 3	(a) 1,221	—	—	*June*
		Farrantane,	,,	488	4 0	4 14	21	20	21	20	21	20	26	17	20	24	16	9	153	79	3	235	63	36 6	2 4	lb. oz. dr.	—	—	*June*
		Castlegregory,	,,	489	3 14	4 3	19	19	18	15	19	18	20	16	16	14	8	—	104	71	7	182	52	28 7½	2 3	(b) 165 5 5	—	—	*June*
		Co Kerry.	,,	490	4 0	5 0	2	9	16	25	19	24	21	22	18	17	19	8	25	136	39	200	28	29 8¼	2 1	oz.	1	—	Oct., *June*
			,,	491	4 0	4 15	4	9	22	21	21	21	26	24	24	21	19	10	59	147	16	222	36	33 5¼	2 2	(c) 26 0	—	—	Oct., *June*
			,,	492	3 12	4 6	20	19	13	—	14	24	24	22	20	20	17	9	48	139	15	202	46	30 9¼	2 2	(d) £9 6 4	—	—	Dec., *June*
2	85	*White Leghorn.* Mrs. W Byrne,	1939 Feb. 17	493	3 8	4 4	21	20	21	20	20	22	22	20	21	20	20	10	8	179	50	237	28	35 10	2 0	(a) 1,202	—	—	Oct. Aug., *June*
		Kilcar,	,,	494	3 13	3 6	21	15	1	—	10	18	20	20	20	7	—	—	82	50	—	132	37	20 4½	2 3	lb oz. dr.	—	—	Oct.
		Curraghboy,	,,	495	4 0	4 6	12	—	7	18	10	17	19	18	9	22	22	4	147	7	4	158	20	23 0¼	2 7	(b) 159 0 15	—	—	Oct.
		Athlone.	,,	496	3 8	5 4	12	22	1	10	22	21	23	24	24	20	19	11	10	162	37	209	18	30 9¼	2 0	oz.	—	—	Oct., *June*
			,,	497	4 0	4 10	23	21	20	21	19	22	24	22	23	23	22	11	92	152	7	251	65	38 9¼	2 3	(c) 25 4	—	—	Oct., *June*
			,,	498	3 11	3 12	22	21	21	19	19	21	20	22	19	17	13	1	6	126	83	215	18	32 2	2 0	(d) £9 0 11½	—	—	*June*
3	89	*White Leghorn.* Sister-in-Charge,	1939 Mar 10	511	3 12	4 14	12	12	18	11	19	21	19	7	5	2	—	—	80	42	4	126	39	20 2¼	2 4	(a) 1,169	—	—	June
		R.D.E. School,	,,	512	3 14	5 10	18	18	19	19	21	20	23	23	21	17	18	11	104	105	19	228	39	34 11¼	2 3	lb oz dr.	—	—	*June*
		Swinford,	,,	513	3 12	5 2	—	2	19	20	20	22	22	25	15	15	21	13	65	121	8	194	25	28 11¾	2 3	(b) 157 13 12	—	—	Oct., *June*
		Co. Mayo.	,,	514	3 13	5 8	16	17	16	16	14	19	22	24	20	20	17	10	95	86	30	211	23	31 11¼	2 3	oz.	2	—	*Aug.*
			,,	515	4 9	6 0	14	—	—	13	17	18	20	22	23	19	21	9	40	119	17	176	—	25 3¼	2 2	(c) 25 9	8	—	Nov.
			,,	516	3 10	5 0	17	19	20	19	17	20	23	23	25	20	19	12	81	123	30	234	34	35 7¼	2 2	(d) £8 16 11½	—	—	*Aug.*
4	88	*White Leghorn.* Miss K Cunningham,	1939 Mar. 13	505	4 6	4 8	14	21	22	22	21	22	22	22	24	19	20	9	195	40	3	238	59	37 0½	2 6	(a) 1,148	—	—	*Aug.*
		Monreade P F.,	,,	506	4 3	4 14	11	16	6	—	—	18	24	22	21	7	8	1	114	19	1	134	32	20 6¼	2 5	lb. oz. dr.	—	—	Dec., June
		Greenhills,	Feb 25	507	4 2	5 0	16	—	—	—	20	26	21	25	24	22	17	9	171	7	2	180	14	26 1½	2 8	(b) 166 8 14	—	—	Nov.
		Kill,	Mar. 13	508	4 0	4 8	15	18	18	19	22	21	24	26	24	21	12	—	88	127	5	220	50	34 1¼	2 3	oz	—	—	Aug.
		Co. Kildare.	,,	509	4 0	5 0	16	7	20	15	21	18	23	23	18	21	16	8	191	13	2	206	45	31 4½	2 6	(c) 27 9	—	—	—
			,,	510	4 0	5 0	4	19	6	—	2	23	22	24	22	20	17	11	99	64	7	170	23	25 8¼	2 4	(a) £8 14 11	1	—	Oct.
5	98	*White Leghorn.* Rev. Bro Dominick,	1939 March	565	4 6	4 6	—	12	19	18	22	19	24	24	21	13	—	9	54	123	4	181	33	28 1¾	2 3	(a) 1,119	1	—	Aug.
		Agricultural College,	,,	566	4 10	5 10	19	19	19	21	19	17	24	19	17	18	13	9	55	131	28	214	41	32 9¼	2 2	lb. oz. dr.	1	—	*June*
		Mountbellew,	,,	567	3 12	4 6	18	8	17	20	20	23	27	20	22	19	19	9	116	86	20	222	28	33 1¾	2 3	(b) 149 15 13	—	—	*June*
		Co. Galway.	,,	568	3 12	4 10	9	17	15	10	15	15	19	16	6	—	—	—	75	36	11	122	32	19 5¾	2 3	oz.	1	—	June
			,,	569	4 2	4 4	18	19	15	18	13	14	15	14	11	11	10	—	50	87	21	158	35	24 8	2 2	(c) 25.7	—	—	—
			,,	570	3 14	4 2	17	14	11	20	21	22	24	24	23	21	16	9	17	166	39	222	22	32 11½	2 1	(d) £8 11 2	2	—	*June*

SECTION V.—ANY NON-SITTING BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of test (lb. oz.)	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug. 3	Aug. 4-Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade — Oct. 1-Dec. 23	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
6	94	*White Leghorn*	1939	541	4 3	4 12	15	—	6	9	20	23	21	26	23	15	20	8	75	68	16	189	6	27 4¼	2 3	(a) 1,113	—	—	Nov.
		Miss K. Cunningham,	Mar. 18	542	4 0	5 8	5	24	21	19	—	16	23	27	25	23	22	11	36	148	10	214	46	33 2	2 2	lb. oz. dr.	1	—	Feb., *Aug*
		Monreade P.F.,	Mar. 13	543	3 13	5 8	17	4	5	18	13	13	22	21	22	9	—	—	57	78	9	144	27	21 7½	2 2	(b) 150 15 11	—	—	Nov., July
		Greenhills,	Mar. 18	544	3 14	4 6	19	21	8	—	18	24	27	28	23	17	8	10	116	81	4	201	45	30 11½	2 3	oz.	—	—	Dec.
		Kill.	,,	545	3 14	4 6	8	19	17	17	19	21	23	22	19	17	14	2	86	109	3	198	45	30 9¼	2 3	(c) 26.0	—	—	—
		Co. Kildare.	Mar. 13	546	4 0	4 10	—	—	—	—	18	26	26	25	23	20	19	10	72	95	—	167	—	23 9¼	2 3	(d) £8 7 8¼	—	—	Oct.
7	100	*White Leghorn*	1939	577	3 11	4 2	9	19	23	20	19	21	23	26	23	19	19	8	4	143	79	226	20	33 5	2 0	(a) 1,102	2	—	—
		Mrs. M. E. Higgins,	Mar. 31	578	3 14	4 6	14	[illegible]	8	21	17	26	25	22	17	14	16	5	66	112	6	154	30	27 5	2 3	lb. oz. dr.	—	—	Nov.
		Carramarla,	,,	579	3 8	3 12	16	21	20	19	20	22	22	22	22	6	17	9	41	122	46	209	13	31 9	2 1	(b) 147 11 9	5	—	—
		Claremorris,	,,	580	3 12	4 8	7	21	15	—	15	22	24	20	21	19	18	10	90	89	13	192	33	29 5	2 3	oz.	1	—	Jan.
		Co. Mayo.	,,	581	3 11	4 0	—	7	17	18	10	29	20	25	19	15	—	—	34	115	6	155	24	23 11½	2 2	(c) 25.7	—	—	Oct., July
			,,	582	4 0	4 3	1	15	21	—	1	26	22	25	18	15	—	—	134	2	—	136	37	21 7	2 7	(d) £8 7 6½	—	—	Oct., July
*	90	*White Leghorn.*	1939	517	3 9	3 8	8	24	20	20	[illegible]	22	24	21	24	23	21	9	—	86	153	239	5	33 11¾	1 15	(a) 1,108	2	—	—
		Mrs. A. M. Nelson,	Feb.	518	3 8	3 6	—	17	16	20	[illegible]	[illegible]	27	27	23	11	11	5	1	110	92	203	4	29 3¼	2 0	lb. oz. dr.	1	—	—
		Derry,	,,	519	3 8	4 0	—	16	[illegible]	18	1	21	22	10	[illegible]	9	2	5	129	39	2	161	33	25 6½	2 4	(b) 145 7 7	—	—	July
		Shercock,	,,	520	3 8	3 14	—	7	[illegible]	—	[illegible]	21	22	24	23	17	16	—	110	24	1	165	20	24 9	2 6	oz	—	—	Dec., *Aug.*
		Co. Cavan.	,,	521	3 11	4 8	—	16	[illegible]	22	21	[illegible]	[illegible]	24	21	23	21	10	22	172	27	221	22	33 3¼	2 1	(c) 25.2	—	—	*June*
			,,	522	3 8	4 0	—	—	—	8	12	15	20	23	21	15	5	—	26	88	5	119	—	17 0½	2 2	(d) £8 3 10½	—	—	Oct., Aug.
8	91	*White Leghorn*	1939	523	4 0	4 0	8	13	20	16	12	15	13	16	17	8	11	—	138	14	1	153	42	23 10½	2 8	(a) 1,052	1	—	Oct., *June*
		Mrs. M. A. Walsh,	Mar. 17	524	3 14	4 7	10	16	[illegible]	17	19	[illegible]	[illegible]	28	29	19	21	10	101	119	4	224	50	34 5	2 3	lb. oz. dr.	1	—	*June*
		Wardstown,	,,	525	4 2	5 8	21	23	21	22	21	19	21	16	9	3	—	—	71	98	5	174	64	28 1¼	2 3	(b) 144 12 13	1	—	Oct., *June*
		Athboy,	,,	526	3 5	4 10	14	21	—	15	[illegible]	17	23	25	24	19	25	15	92	100	14	206	21	30 6¼	2 3	oz	—	—	Oct., *June*
		Co. Meath.	,,	527	4 4	4 6	11	19	13	17	18	18	21	15	14	—	1	1	9	105	34	148	33	22 11½	2 0	(c) 26.4	1	—	Oct.
			,,	528	4 8	4 8	20	21	19	3	1	24	23	17	—	5	10	4	97	45	5	147	63	23 6½	2 3	(d) £8 3 5½	—	—	Oct.
9	83	*White Leghorn.*	1939	481	4 2	5 4	7	17	14	17	11	19	13	16	19	8	7	—	10	72	57	139	11	21 0¾	2 0	(a) 1,044	15	—	*June*
		Miss A. Fitzgerald,	March	482	3 12	D	13	14	—	5	18	21	24	25	12	—	—	—	50	65	17	132	13	19 9	2 2	lb. oz. dr.	—	—	—
		Ardgoul,	,,	483	4 3	4 9	15	23	18	17	14	17	21	22	24	21	22	9	93	118	12	223	45	34 5¼	2 3	(b) 143 4 10	—	—	*June*
		Rathkeale,	,,	484	4 6	5 6	13	16	20	18	17	22	23	22	21	17	15	10	149	59	9	217	45	33 4	2 4	oz.	—	—	*Aug.*
		Co. Limerick.	,,	485	3 9	4 15	14	17	12	17	12	18	15	9	5	9	4	4	114	21	1	136	46	21 9¾	2 5	(c) 26.4	—	—	*June*
			,,	486	3 12	4 12	10	20	19	15	19	17	21	18	13	19	16	5	146	47	4	197	48	30 8½	2 4	(d) £8 1 1¼	—	—	*June*

*Disqualified under Clause 29 (more than 20 per cent second grade eggs). D = Dead.

SECTION V—ANY NON-SITTING BREED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz	Weight: At close of test lb. oz.	Eggs Laid: Oct 1-Oct 28	Oct. 29-Nov 25	Nov 26-Dec 23	Dec 21-Jan 20	Jan 21-Feb. 17	Feb 18-Mar 16	Mar 17-Apl 13	Apl 11-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
10	97	*White Leghorn.*	1939 Mar. 1	559	4 2	5 4	12	18	20	21	29	23	26	22	25	22	24	11	34	195	16	245	47	37 4½	2 2	(a) 1,038	1	—	*Nov.*
		Mrs. M. A. Forster,	,,	560	4 0	5 4	—	7	—	5	5	19	21	21	22	13	—	4	32	81	4	117	5	17 8	2 3	lb oz. dr.	—	—	Oct.,Aug.,*June*
		Tattybrack,	,,	561	4 0	5 4	15	—	—	8	14	19	19	23	20	21	16	7	40	108	14	162	9	23 3	2 2	(b) 141 1 14	—	—	Nov.
		Rockcorry,	,,	562	3 11	4 8	3	19	10	7	13	18	21	17	9	8	—	1	83	36	—	119	3	18 11¼	2 4	oz	—	—	*June*
		Co. Monaghan	,,	563	3 8	4 8	4	16	11	4	19	21	27	21	19	19	20	9	108	74	4	186	27	28 6¾	2 4	(c) 26 1	1	—	—
			,,	564	4 0	4 8	16	17	20	3	21	22	22	24	21	21	18	9	113	89	16	209	33	31 8	2 3	(d) £7 16 6½	—	—	—
11	86	*White Leghorn.*	1939 Mar 10	499	3 14	4 0	6	4	17	18	16	16	19	11	7	—	5	9	93	38	2	133	29	20 6¼	2 4	(a) 1,024	—	—	Oct., June
		Mrs. M Hanly,	,,	500	4 0	5 0	1	19	19	20	20	21	21	21	21	20	17	1	59	144	10	213	46	32 11¾	2 2	lb oz. dr.	1	—	*Aug.*
		Cooga,	,,	501	4 2	4 8	9	—	—	—	19	21	17	19	20	10	10	6	13	90	28	131	3	18 4¼	2 1	(b) 141 2 6	—	—	Oct
		Doon,	,,	502	4 0	5 0	18	18	11	13	9	14	19	19	17	10	15	11	131	43	2	176	49	27 3¼	2 4	oz	—	—	*Aug.*
		Co. Limerick.	,,	503	4 4	4 12	16	17	6	—	17	21	22	21	1	20	17	7	136	41	3	180	39	27 6	2 4	(c) 26 5	—	—	Jan.
			,,	504	4 2	4 4	12	12	16	14	—	19	22	24	22	2	11	8	147	40	4	191	40	20 1½	2 4	(d) £7 15 9	—	—	—
†	93	*White Leghorn.*	1939 Mar. 1	535	4 6	4 11	11	23	16	17	11	2	16	17	16	13	13	7	145	46	1	192	62	30 5¼	2 4	(a) 946	—	—	*Aug.*
		Mrs M. E Shanley,	,,	536	4 4	5 11	18	19	16	19	9	21	17	19	4	3	3	—	101	26	1	128	53	20 11½	2 5	lb oz dr.	—	—	*June*
		Dromard,	Mar 25	537	3 12	4 12	23	24	29	11	16	20	19	19	18	17	6	6	44	149	9	202	68	32 1	2 2	(b) 129 14 8	—	—	*Aug.*
		Dromod,	,,	538	4 0	5 8	8	22	19	14	18	20	20	24	17	17	—	1	26	147	8	181	48	28 10¼	2 2	oz	2	—	Oct., Aug.
		Co. Leitrim	,,	539	4 6	D	4	25	19	21	6	16	18	16	2	—	D	—	87	36	2	125	51	20 9¼	2 4	(c) 26 4	—	—	Oct., *June*
			,,	540	3 10	5 0	—	—	7	12	8	16	12	19	15	14	13	2	46	70	2	118	10	17 5¼	2 3	(d) £7 10 7½	—	—	Oct., *Aug.*
†	95	*White Leghorn*	1939 Feb	547	3 12	4 0	12	24	22	21	18	18	21	22	18	8	5	—	101	70	9	180	55	29 11¼	2 3	(a) 933	—	—	Oct., Aug.
		Mrs. A. M Nelson,	,,	548	3 8	4 10	11	22	23	18	19	20	23	22	24	12	13	5	11	135	76	222	7	33 5¼	2 0	lb oz. dr.	1	—	Oct., *Aug.*
		Derry,	,,	549	3 8	4 8	—	10	14	21	21	23	25	23	21	27	18	9	176	25	2	203	25	30 8¼	2 5	(b) 123 10 4	1	—	Oct.
		Shercock	,,	550	3 8	4 6	1	19	21	18	21	19	24	20	24	29	16	8	151	47	5	203	40	31 5¼	2 5	oz.	1	—	Oct.
		Co. Cavan.	,,	551	3 10	5 2	—	—	15	18	9	9	19	16	11	4	—	5	63	42	1	106	20	16 1½	2 4	(c) 26 5	—	—	Oct., June
			,,	552	3 14	D	—	—	—	6	4	—	D	—	—	—	—	—	9	1	—	10	—	1 6½	2 6	(d) £7 3 3½	—	—	Oct.
12	96	*White Leghorn*	1939 Mar 13	553	3 8	5 0	7	15	1	4	1	15	18	19	19	15	—	4	25	64	27	116	1	17 4	2 1	(a) 974	—	—	Oct., Aug.
		Miss A M Dempster,	,,	554	3 8	4 11	7	4	—	9	21	20	23	21	22	19	18	10	21	138	17	176	—	25 3¼	2 2	lb. oz. dr.	3	—	Nov.
		Emo Park,	,,	555	3 8	4 8	—	17	13	1	2	24	24	21	21	20	25	16	4	101	93	198	—	28 0	2 0	(b) 131 11 14	5	—	Jan.
		Portarlington,	,,	556	3 8	4 10	—	12	14	21	19	2	25	21	23	17	20	9	146	41	4	191	29	28 11	2 4	oz.	—	—	Oct.
		Laoighis.	,,	557	3 8	5 4	7	17	6	—	—	16	20	19	19	16	16	9	127	16	2	145	28	22 1¼	2 6	(c) 26 0	—	—	Oct.
			,,	558	3 8	4 6	—	—	—	14	1	18	18	22	22	22	22	9	109	47	1	148	2	21 2¼	2 4	(d) £7 2 10½	—	—	Oct.

†Disqualified under Clause 29 (Pen produced less than 960 eggs). D = Dead.

SECTION V.—ANY NON-SITTING BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz)	Weight: At close of test (lb. oz)	Eggs Laid: Oct 1-Oct 29	Oct 29-Nov 25	Nov 26-Dec 23	Dec. 24-Jan 20	Jan 21-Feb 17	Feb. 18-Mar 16	Mar 17-Apl 13	Apl 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug. 4-Aug. 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moult ns. (Neck moults in italics)
†	92	*White Leghorn.* Mr. D. A. Dennis,	1939 Feb. 21	529	4 3	5 0	9	16	19	20	22	23	25	17	25	8	11	4	148	47	4	199	43	30 11¾	2 4	(a) 879	—	3	Oct., June
		The Burrow,	,,	530	4 6	6 0	—	—	—	14	4	3	10	7	—	—	—	—	15	19	4	38	—	5 6¼	2 3	lb. oz. dr.	—	—	Oct., *June*
		Portrane,	,,	531	4 5	4 12	13	24	21	21	21	23	24	24	24	7	16	8	56	138	32	226	31	34 10¼	2 2	(b) 121 8 4	6	1	June
		Donabate,	,,	532	4 3	4 8	2	7	16	16	12	3	19	20	20	19	17	8	102	45	12	159	16	23 9¼	2 4	oz.	—	—	Feb., *June*
		Co. Dublin.	,,	533	4 0	3 0	—	2	8	14	18	15	20	19	7	2	—	—	31	67	7	105	5	15 9	2 2	(c) 26 5	—	—	Oct.
			,,	534	4 0	5 2	—	—	—	18	18	21	20	21	17	13	16	8	122	30	—	152	2	22 0¼	2 5	(d) £6 12 11	—	—	Oct., *June*
†	99	*White Leghorn.* Mrs. F. E. Hanbidge,	1939 Mar. 13	571	3 8	4 2	20	14	19	19	20	21	19	19	17	5	9	6	8	107	73	188	17	28 0¼	2 0	(a) 660	4	—	Oct.
		Blackrath,	,,	572	3 10	D	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	lb oz. dr.	—	—	—
		Ballytore,	,,	573	3 12	D	—	—	5	15	—	—	—	D	—	—	—	—	—	12	8	20	8	3 3¼	2 0	(b) 86 6 11	—	—	Oct.
		Co. Kildare.	,,	574	3 8	4 10	5	6	11	15	17	19	26	6	—	—	—	—	87	16	2	105	21	16 3¼	2 5	oz.	—	—	Oct., Aug., *June*
			,,	575	3 8	4 10	2	17	21	16	16	20	24	23	21	17	17	10	56	137	11	204	35	31 4	2 2	(c) 25.1	3	—	Oct.
			,,	576	3 15	3 12	17	5	19	19	18	20	22	9	5	3	5	1	7	103	33	143	24	21 8¼	2 0	(d) £5 0 7¼	2	—	Oct.

†Disqualified under Clause 20 (Pen produced less than 900 eggs). D = Dead.

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—17 PENS..

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct 1–Oct 28	Oct 29–Nov 25	Nov 26–Dec 23	Dec 24–Jan 20	Jan 21–Feb 17	Feb 18–Mar 16	Mar 17–Apl 13	Apl 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug 3	Aug 4–Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1–Dec 29	Value per Pullet (s d)	Average Weight of Eggs per Pullet (oz. dr)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	103	*Light Sussex.*	1939 —	595	5 12	6 8	22	23	22	24	22	21	22	21	10	1	—	—	44	72	72	188	14	29 0	2 1	(a) 1,304	—	—	Aug.
		Sister-in-Charge,	Feb. 8	596	6 3	7 8	15	18	21	18	21	20	22	18	19	14	15	6	118	88	1	207	57	32 2¼	2 4	lb oz. dr	—	—	*June*
		St. Martha's College,	,,	597	5 8	6 4	—	22	19	18	18	20	22	22	18	20	16	10	16	179	10	205	39	31 8	2 1	(b) 174 9 6	—	—	Oct.
		Sion,	Feb. 16	598	6 0	6 4	24	27	23	21	22	21	20	23	9	1	11	12	172	42	—	214	78	34 4	2 5	oz	—	—	June
		Navan,	Feb 24	599	6 0	6 8	19	24	22	22	21	23	23	23	15	20	20	9	4	167	73	244	15	36 7¾	2 0	(c) 25 7	1	—	*June*
		Co. Meath.	Mar. 4	600	6 4	7 8	23	22	18	20	20	20	24	25	23	23	19	9	82	150	14	246	55	37 10¾	2 2	(d) £10 1 8¾	—	—	—
2	105	*Light Sussex.*	1939 Feb.	607	6 2	6 6	22	21	21	19	18	19	23	26	24	9	21	5	131	92	5	228	66	35 5	2 3	(a) 1,248	1	1	*June*
		Mrs. J. H.-Hutchinson,	Mar.	608	6 6	6 9	22	21	24	22	20	23	27	27	25	24	23	11	14	234	21	269	66	41 1	2 1	lb oz dr	—	—	*June*
		Lissen Hall,	Feb.	609	5 10	6 12	18	5	—	—	2	23	16	22	11	9	15	5	105	20	1	126	23	18 7¼	2 4	(b) 168 11 13	—	4	Nov., *June*
		Swords,	Mar.	610	5 12	5 14	23	10	—	—	19	25	28	27	3	25	22	10	4	148	40	192	11	27 4	2 0	oz	—	1	Nov.
		Co. Dublin.	,,	611	6 4	5 12	20	14	18	13	13	17	20	20	15	22	12	—	177	7	—	184	56	28 7¼	2 6	(c) 26 0	—	1	Aug.
			,,	612	6 0	6 4	24	23	23	19	23	23	24	26	28	14	19	3	55	178	16	249	62	38 6½	2 2	(d) £9 9 7	—	—	—
3	112	*Light Sussex.*	1939 Feb 12	691	5 8	5 12	27	24	25	22	22	24	20	24	23	22	8	9	78	161	11	250	71	39 5¾	2 2	(a) 1,178	—	1	Aug., *June*
		Sister-in-Charge,	Feb 24	692	6 0	7 3	—	11	19	17	18	23	20	20	18	18	16	10	134	56	—	190	35	29 3¼	2 4	lb oz dr.	—	—	—
		St Mary's Abbey,	Mar. 2	693	5 12	5 10	20	17	19	15	13	18	17	15	15	7	—	—	120	26	—	156	59	25 2¼	2 5	(b) 163 0 4	—	—	—
		Glencairn,	,,	694	5 8	6 0	—	—	—	18	20	26	23	22	23	13	20	10	124	50	1	175	4	25 3¼	2 5	oz	—	1	Oct., June
		Co. Waterford.	Mar. 6	695	5 14	6 0	19	22	11	20	24	23	26	22	23	21	18	6	88	141	6	235	56	35 11½	2 3	(c) 26 6	—	—	Oct., Aug.
			Mar. 24	696	5 8	6 4	—	—	—	22	17	22	21	22	18	22	18	10	50	119	3	172	2	24 10¼	2 3	(d) £9 0 0½	—	—	Oct.
*	117	*Barred Rock.*	1939 Feb. 8	685	4 14	5 0	—	—	—	17	21	24	20	24	13	21	12	9	6	88	73	167	—	22 7¾	2 0	(a) 1,181	—	2	Oct.
		Mrs. M. A. Kelly,	Feb. 20	686	5 5	6 0	11	17	8	—	14	18	24	23	23	23	19	9	117	69	3	189	34	28 7	2 4	lb. oz dr.	1	—	Oct.
		Carranstown,	,,	687	5 1	5 8	10	25	26	23	20	24	28	25	23	8	23	1	7	14	215	236	6	32 8¼	1 14	(b) 153 1 13	4	1	Oct., *June*
		Ballivor,	,,	688	5 12	8 0	—	—	—	10	21	23	21	17	21	17	2	2	126	8	—	134	—	19 6	2 8	oz	—	—	Oct., Aug.
		Co. Meath.	,,	689	5 0	5 8	23	12	24	18	17	19	22	22	16	14	14	7	15	144	49	208	26	31 4¼	2 0	(c) 24 9	—	1	Oct., Aug., *June*
			,,	690	5 0	5 4	24	22	21	23	23	22	22	23	20	21	18	8	12	201	34	247	53	37 11¼	2 1	(d) £8 12 9	1	—	Oct.
*	116	*Barred Rock.*	1930 Feb 15	673	5 0	6 1	18	24	16	15	4	14	25	26	27	22	21	10	27	186	9	222	56	34 1½	2 1	(a) 1,126	—	—	Feb.
		Mrs. N. Browne,	,,	674	5 0	5 8	22	25	23	23	21	20	24	21	10	19	5	9	15	138	69	222	26	33 11¾	2 0	lb oz dr.	—	2	Aug., *June*
		Burrane Lower,	,,	675	5 0	5 6	—	—	18	22	22	23	25	23	25	17	15	7	30	157	10	197	16	29 3	2 2	(b) 144 7 15	—	—	Oct.
		Knock,	,,	676	5 0	D	3	9	14	6	—	10	17	20	—	—	—	—	52	8	1	61	25	9 11¾	2 4	oz	—	—	Oct., Feb.
		Ennis,	,,	677	5 8	6 0	20	27	21	23	20	23	24	26	16	10	11	12	7	117	109	233	9	34 7¾	1 15	(c) 24 6	—	3	*June*
		Co. Clare.	,,	678	5 0	5 14	10	19	24	23	20	22	23	20	12	11	7	—	8	134	49	191	31	29 3½	2 0	(d) £8 11 3½	—	—	—

*Disqualified under Clause 29 (more than 20 per cent second grade eggs).   D = Dead.

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of test (lb. oz.)	Eggs Laid: Oct. 1-Oct 28	Oct 29-Nov 25	Nov. 26-Dec 23	Dec 24-Jan. 20	Jan 21-Feb 17	Feb. 18-Mar 16	Mar 17-Apl 13	Apl. 14-May 11	May 12 June 8	June 9-July 6	July 7-Aug 3	Aug 4 Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1-Dec 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
4	107	*Light Sussex.* Mrs M. Riordan,	1939 Jan. 9	619	6 10	7 3	19	15	17	17	19	19	17	18	14	10	11	2	34	136	11	181	56	28 3¼	2 2	(a) 1,103	—	1	Aug., *June*
		Glenleigh,	,,	620	6 3	6 0	21	21	18	17	16	21	22	21	21	22	18	19	183	41	1	225	64	35 5¾	2 4	lb. oz. dr.	—	—	—
		Clogheen,	,,	621	6 0	6 0	25	[illegible]	17	19	18	21	[illegible]	23	21	11	20	1	67	130	5	212	54	30 10	2 2	(b) 148 1 5	—	1	—
		Co. Tipperary.	,,	622	6 8	7 [illegible]	22	22	20	19	19	21	19	18	11	[illegible]	9	1	[illegible]	116	54	207	33	31 8¾	2 0	oz.	—	—	—
			,,	623	6 4	6 0	18	—	—	3	22	21	11	11	4	18	14	—	87	43	1	131	18	18 11¾	2 4	(c) 25 8	—	3	Nov.
			,,	624	6 4	7 4	21	20	3	8	8	22	21	21	1	—	19	10	33	116	5	154	42	23 6¾	2 2	(d) £8 8 10¼	—	2	Oct., Feb., June, *June*
*	115	*Buff Rock.* Mrs M. Walshe,	1939 Mar 15	655	5 0	6 0	16	20	19	18	19	19	22	8	—	—	—	—	77	58	6	141	54	22 11¼	2 3	(a) 1,066	1	1	June
		Tullamore,	,,	656	5 2	6 2	8	[illegible]	20	24	23	25	15	21	10	21	11	8	2	49	163	214	—	30 8¾	1 14	lb. oz. dr.	5	2	June
		Listowel,	Feb. 12	657	5 3	5 6	9	21	21	21	19	22	24	23	13	23	23	—	83	120	7	210	55	34 0¾	2 3	(b) 141 11 8	1	1	—
		Co Kerry.	,,	658	5 1	D	8	23	2	7	21	7	D	—	—	—	—	—	1	8	59	68	2	10 6¾	1 14	oz	15	—	Oct.
			,,	659	5 12	6 8	21	22	[illegible]	21	21	13	20	14	14	21	3	11	203	3	—	206	67	32 10	2 7	(c) 25.5	—	3	*June*
			Mar. 21	660	5 2	5 0	19	24	24	24	23	22	23	11	14	15	14	5	15	148	55	218	26	33 5¾	2 0	(d) £8 4 6¾	1	4	Oct., June
*	108	*Light Sussex.* Miss E. Walsh,	1939 Feb. 20	625	5 8	5 8	—	—	—	18	25	24	22	26	24	24	21	12	8	132	56	196	2	27 1¾	2 0	(a) 1,042	2	—	Oct.
		Ballylemon Lodge,	,,	626	6 6	7 14	17	19	18	8	—	5	27	16	21	7	21	12	15	135	21	171	47	25 11¾	2 1	lb oz. dr.	—	2	Jan., Aug.
		Cappagh,	Mar. 3	627	5 12	5 14	2	10	24	23	14	6	11	—	3	—	1	—	5	57	32	94	31	15 2	2 0	(b) 134 3 3	1	—	Oct., *Aug.*
		Co. Waterford.	,,	628	5 12	6 12	19	23	24	20	19	10	19	16	18	9	10	7	41	155	7	203	62	32 4¾	2 2	oz.	—	1	July
			,,	629	5 12	6 14	21	19	21	19	19	11	21	24	19	20	19	9	65	160	5	230	64	35 8	2 2	(c) 24.7	—	—	*June*
			Feb. 20	630	6 0	5 14	18	15	—	7	16	12	20	17	14	11	7	11	3	53	92	148	2	20 6¾	1 15	(d) £7 16 10¼	6	2	Nov., June
5	106	*Light Sussex.* Mrs M Roche,	1939 Feb 9	613	7 2	8 0	15	17	11	10	16	19	23	22	19	18	19	10	98	67	31	196	19	29 4	2 2	(a) 967	—	—	*June*
		Talbot Hall,	,,	614	6 4	6 6	21	20	—	—	[illegible]	25	25	21	—	9	21	12	99	56	2	157	39	23 9¼	2 3	lb oz. dr.	—	2	Dec., June
		New Ross,	Feb. 19	615	5 10	D	14	—	13	18	12	—	—	—	—	—	—	—	40	15	2	57	29	9 4	2 4	(b) 136 1 14	—	1	Nov.
		Co. Wexford.	Mar 13	616	5 12	5 6	20	13	—	2	10	24	23	22	21	8	20	10	57	118	4	179	30	26 6¼	2 3	oz.	—	—	Dec., *June*
			Feb. 19	617	5 12	6 0	20	18	16	[illegible]	3	21	24	8	23	9	8	10	147	16	—	163	56	25 7½	2 6	(c) 27.0	—	3	Jan., June
			Mar. 13	618	6 8	6 14	21	19	14	21	21	24	23	22	17	15	13	5	191	24	—	215	58	33 4½	2 6	(d) £7 8 0	—	—	*June*
†	114	*Buff Rock.* Mrs A. Coleman,	1939 March	649	5 [illegible]	5 12	19	18	14	14	15	16	20	20	19	15	12	6	78	92	18	188	36	28 10¾	2 2	(a) 951	—	—	*June*
		Ballycullen House,	,,	650	6 0	6 6	13	20	6	—	15	11	23	25	22	20	19	9	72	112	7	191	35	28 11¼	2 3	lb. oz. dr.	—	—	Dec., *Aug.*
		Croom,	,,	651	5 0	D	17	11	11	15	11	9	—	6	D	—	—	—	3	45	30	78	13	12 7	2 0	(b) 130 6 11	—	—	Nov.
		Co. Limerick.	,,	652	5 2	6 12	5	19	18	18	19	29	27	22	21	16	5	—	183	5	—	188	47	29 7½	2 7	oz.	—	1	Oct., June
			,,	653	5 0	5 12	1	17	11	—	13	23	19	7	16	16	8	7	33	92	13	138	25	21 3	2 2	(c) 26.3	—	4	Oct., June
			,,	654	5 0	5 10	—	9	19	17	12	19	20	23	19	14	10	6	59	107	2	168	31	25 11½	2 3	(d) £7 7 2¾	—	—	Oct., Aug.

* Disqualified under Clause 29 (more than 20 per cent. second grade eggs). † Disqualified under Clause 29 (pen produced less than 960 eggs). D. = Dead.

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz	Weight At close of test lb. oz.	Oct 1-Oct 28	Oct 29-Nov 25	Nov 26-Dec 23	Dec 24-Jan 20	Jan 21-Feb 17	Feb 18-Mar 16	Mar 17-Apl 13	Apl 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug 4-Aug 17	Special Grade	First Grade	Second Grade	Total	First Grade – Oct. 1-Dec 29	Value per Pullet s. d	Average Weight of Eggs per Pullet oz. dr	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
	102	*Light Sussex.*	1939																										
		Sister-in-Charge,	Feb. 20	589	5 8	6 12	—	12	22	20	20	6	3	6	—	—	4	6	72	37	—	109	48	18 6¼	2 4	(a) 892	—	1	Oct, Aug, *June*
		Coolarne Tech. School,	,,	590	5 12	7 4	10	14	21	23	3	12	11	12	13	2	—	—	112	19	2	124	49	20 1¼	2 7	lb. oz dr.	—	—	Feb., June
		Athenry,	Feb. 10	591	6 4	6 14	22	10	19	13	16	13	15	9	19	16	10	2	141	20	—	161	63	25 7¼	2 6	(b) 129 9 5	—	—	Aug, *June*
		Co. Galway.	Feb 12	592	5 7	D	24	6	—	16	4	10	22	9	D	—	—	—	36	62	2	100	30	15 3	2 2	oz	1	—	Nov, Feb.
			Feb 21	593	5 12	6 0	20	19	21	19	5	17	18	21	22	22	25	8	210	3	—	213	65	33 3¼	2 7	(c) 27 9	—	—	*June*
			Feb. 20	594	5 13	5 0	14	25	—	23	27	22	26	11	18	—	18	1	74	109	2	185	44	28 6	2 3	(d) £7 1 4	—	4	Oct, June
*†	111	*Light Sussex.*	1939																										
		Mrs. C. MacDonald,	Feb. 4	643	5 12	6 4	—	—	—	10	25	23	23	26	22	14	12	14	2	51	113	166	—	21 6¼	1 15	(a) 922	—	3	Oct, *June*
		Laharan,	,,	644	5 8	5 14	—	—	4	20	18	19	17	11	11	6	4	—	36	73	1	110	8	16 4	2 3	lb. oz. dr	—	—	Oct.
		Minane Bridge,	,,	645	5 12	7 0	—	14	24	23	22	24	26	22	12	15	27	9	2	145	69	216	4	31 10¼	2 0	(b) 115 15 10	—	1	Oct., June
		Co. Cork.	,,	646	5 8	5 2	12	17	8	—	15	4	20	18	16	5	13	11	2	8	127	137	1	18 3	1 13	oz	52	1	Jan, Aug., *June*
			,,	647	5 12	6 0	19	23	29	17	9	7	8	3	15	14	17	11	41	103	19	163	51	25 11	2 2	(c) 24 2	—	2	*June*
			,,	648	5 8	D	—	18	22	22	21	23	24	—	D	—	—	—	25	99	6	130	43	21 2¼	2 2	(d) £6 15 1	—	1	Oct.,
*†‡	109	*Light Sussex.*	1939																										
		Mrs C MacDonald,	Jan 27	631	5 8	7 2	—	4	25	23	7	23	25	21	11	6	11	5	35	116	10	161	32	24 9¼	2 2	(a) 878	—	4	Oct., June
		Laharan,	,,	632	5 8	5 8	26	9	—	7	24	22	12	29	16	6	13	9	—	4	160	164	1	21 4¼	1 13	lb. oz dr.	22	5	Dec., *June*
		Minane Bridge,	,,	633	5 14	5 10	—	29	21	21	22	25	23	11	13	9	8	—	5	131	30	163	39	25 10¼	2 0	(b) 108 13 15	1	3	Oct, June
		Co. Cork	,,	634	5 14	6 8	12	26	18	21	10	7	—	3	—	1	3	1	25	62	15	102	56	17 9¼	2 1	oz	1	—	June
			,,	635	5 8	4 10	1	—	23	22	17	13	13	11	—	1	—	—	1	13	87	101	7	14 4¼	1 14	(c) 23 8	15	—	Oct, Aug., *June*
			,,	636	5 8	D	23	22	22	20	15	21	22	16	9	9	25	—	18	95	68	184	21	28 3¼	2 0	(d) £6 12 5¼	—	—	—
†	104	*Light Sussex.*	1939																										
		Mrs B Clifford,	Feb 20	601	5 8	6 0	13	18	13	21	13	9	10	7	10	14	6	3	6	102	34	142	35	22 2	2 0	(a) 800	—	—	*June*
		Knockagerry,	,,	602	5 10	D	13	19	35	—	—	—	—	—	—	—	—	—	—	25	15	40	25	7 0¼	1 15	lb oz dr.	—	—	—
		Mitchelstown,	,,	603	6 1	7 8	18	21	19	19	17	18	14	14	15	11	17	9	2	107	83	192	48	28 7¼	1 15	(b) 104 13 11	3	—	*Aug.*
		Co. Cork.	,,	604	5 12	7 4	11	20	17	13	16	14	—	—	—	—	2	—	36	58	2	96	52	16 7¼	2 2	oz.	—	—	April, *April*
			,,	605	5 8	7 2	—	12	7	8	18	21	24	10	21	19	17	1	126	41	—	167	19	25 1¼	2 4	(c) 25 2	—	—	Oct, May, *Aug.*
			,,	606	6 0	6 10	8	7	22	21	20	19	8	22	12	18	—	6	74	81	8	163	37	25 8¼	2 3	(d) £6 5 3¼	—	2	Nov. Aug., *June*
*†	110	*Light Sussex.*	1939																										
		Mrs. L. Hastings,	Mar.	637	6 0	7 4	10	—	—	11	21	11	12	20	14	11	17	12	7	98	30	135	1	18 8¼	2 1	(a) 825	1	6	Oct., Mar. *June*
		Friarstown House,	Feb.	638	6 4	7 4	15	1	14	6	20	13	17	14	14	12	6	8	6	107	27	140	28	20 5¼	2 1	lb oz. dr.	1	4	Oct, Aug *June*
		Limerick.	Mar.	639	6 3	7 8	—	—	—	13	24	22	21	24	17	14	13	7	27	119	12	158	—	22 6¼	2 2	(b) 105 5 2	1	—	Oct., *July*
			,,	640	7 0	6 8	11	—	—	—	18	12	19	9	6	13	10	—	14	64	20	98	1	13 6¼	2 1	oz.	1	5	Oct. June, *June*
			Feb.	641	6 3	7 12	9	10	8	11	9	22	16	14	11	9	11	8	14	87	37	133	11	20 4¼	2 0	(c) 24 5	2	6	Oct., Aug., *June*
			,,	642	7 2	8 3	21	—	12	16	17	10	19	16	13	10	11	11	—	100	56	156	22	22 3	2 0	(d) £5 17 11	1	6	Oct., Mar. Aug.

*Disqualified under Clause 29 (more than 20 per cent. second grade eggs).
†Disqualified under Clause 29 (Pen produced less than 960 eggs).
‡Disqualified under Clause 26 (eggs failed to reach the standard weight of 24 oz. per dozen).
D = Dead.

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival	Weight: At close of test	Eggs Laid: Oct. 1-Oct 28	Oct 29 Nov 25	Nov 26 Dec 23	Dec 24-Jan 20	Jan. 21 Feb. 17	Feb 18-Mar 16	Mar. 17 Apl 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7 Aug 3	Aug. 4-Aug 17	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1-Dec. 20	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen. (b) Total weight. (c) Av. weight per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting. (Neck moults in italics)
					lb. oz	lb. oz.																		s. d.	oz dr.				
		Light Sussex.	1939																										
†	101	Mrs. L. Hastings,	Jan 26	583	6 8	5 8	—	11	17	6	5	—	—	—	—	—	—	—	2	21	16	39	13	7 0¾	2 0	(a) 675	—	—	Oct
		Friarstown House,	March	584	6 4	D	—	20	18	6	D	—	—	—	—	—	—	—	3	26	15	44	26	8 3¼	2 0	lb. oz. dr.	—	—	Oct.
		Limerick.	Jan. 1	585	6 4	6 12	20	4	—	1	21	23	24	5	19	10	9	6	66	74	2	142	23	20 10	2 3	(b) 89 10 6	—	4	Nov.,Aug.,*June*
			Feb.	586	6 4	7 6	16	—	—	1	14	14	14	10	11	10	10	5	5	82	18	105	14	14 10	2 1	oz.	—	4	Nov., July
			Feb.	587	6 8	6 10	23	21	21	20	20	19	20	22	22	6	14	—	111	85	12	208	58	32 7	2 3	(c) 25.5	—	1	June
			Mar.	588	6 2	6 8	15	2	20	—	—	18	15	22	10	16	13	—	31	91	15	137	29	20 6	2 2	(d) £5 4 1½	1	6	Oct.,Aug.,*June*
		Buff Rock.	1939																										
*†	118	Miss K. Hayes,	Feb. 7	661	5 0	6 0	18	23	21	20	21	22	22	22	18	11	—	—	1	44	153	198	20	28 8	1 14	(a) 660	2	1	Aug.
		Frenanes,	,,	662	5 0	D	—	13	19	10	11	19	21	19	8	5D	—	—	6	86	36	128	29	19 9¼	2 0	lb. oz. dr.	—	2	Oct.
		Rosscarbery,	Mar. 3	663	5 0	6 2	—	—	17	8	16	17	20	20	9	15	5	6	47	81	5	133	21	20 0¼	2 3	(b) 83 13 9	—	2	Oct., Aug.
		Co. Cork.	,,	664	5 0	4 14	—	—	—	—	—	—	—	—	7	13	15	—	3	30	2	35	—	4 9	2 2	oz.	—	—	Oct.
			,,	665	5 1	7 4	1	10	11	5	10	10	1	2	—	—	—	—	17	31	2	50	20	8 7½	2 2	(c) 24 4	—	—	Oct., May
			,,	666	5 0	D	9	19	14	13	15	15	16	15	—	D	—	—	15	90	11	116	43	18 10½	2 1	(d) £5 0 8½	—	—	Oct.

* Disqualified under Clause 29 (more than 20 per cent. second grade eggs). † Disqualified under Clause 29 (pen produced less than 960 eggs). D. = Dead.

NOTES AND MEMORANDA

SCHEME OF GRANTS FOR ENCOURAGING THE IMPROVEMENT OF FARMS

With the two-fold object of assisting farmers in the carrying out of improvement works of a reproductive nature on their holdings and in providing additional employment in rural areas, a scheme of grants for farm improvements works has been put into operation.

Particulars of the conditions under which grants are made available are set out hereunder.

1. The Scheme shall apply to all holdings having a Poor Law Valuation on the agricultural land not exceeding £200 and owned by persons who earn their living solely or mainly by farming.

2. Grants will be payable to rated occupiers for approved improvements works such as :–

   (*a*) field drainage, including improvement and cleaning of watercourses ;

   (*b*) reclamation including (i) drainage where necessary and (ii) removal of bushes, scrub, rocks and stones ;

   (*c*) construction or improvement of fences ;

   (*d*) improvement of farmyards (excluding buildings), and

   (*e*) improvement of farm roadways.

3. Subject to the limitations mentioned hereafter and to the conditions of the Scheme being fulfilled grants shall be equivalent to 50 per cent. of the approved estimated cost of the labour required for improvement works carried out in the season. The approved estimate shall not exceed twice the Poor Law Valuation on the agricultural land, and if an applicant desires to proceed with work requiring a labour cost above that limit the additional labour cost must be borne wholly by himself. In the case of small holdings, however, where the Poor Law Valuation on the agricultural land does not exceed £10, improvement works entailing an estimated labour value of not more than £20 may be approved.

4. Except in Congested Districts, grants will not be paid for improvement works entailing a labour cost of less than £10.

5. The maximum grant payable to any applicant in respect of the season shall be £100 and the minimum grant £5, except in Congested Districts where a minimum grant of £1 may be allowed.

6. Applications must be made on the prescribed form and will be dealt with in the order of their receipt up to the limits of the money available. Some preference may, however, be given to applicants who employ additional hired labour.

7. Joint co-ordinated works between the rated occupiers of adjoining lands may be approved.

8. Applicants must agree to carry out the improvement works within a prescribed time and to the satisfaction of the Minister.

9. Tillage of land reclaimed under the Scheme will be a condition of payment of the grant where the area of arable land in the holding is considered insufficient.

10. This Scheme shall not include any improvement works which would normally come under any other Scheme or Statute.

11. Payment of grants for approved improvement works carried out to the satisfaction of the Minister will be made as soon as possible after the completion of the work.

12. The decision of the Minister in all matters relating to the Scheme shall be final.

THE HORSE COMES BACK.

Signs are not wanting that the horse is coming into his own again, not only as a useful farm and city worker but also as an essential part of modern army transport.

The craze for mechanisation reached its height after the close of the Great War, and motor haulage was the fashion on farm and road and in the army. It is said that France has not yet recovered from the depletion of her stock of horses during the post-war years when breeders sold their yearlings in despair to the first buyer and many horses went out of the country. To-day the tide is turning and the French, in company with other nations have been revising their ideas as to the relative usefulness of the horse and the motor.

Some important investigations in animal mechanics have been carried out by the French Government at their Breeding Station in N. Africa and

three interesting papers by the Director of the Station (Dr. H. Velu, V.S.) have recently been presented to the French Academy of Agriculture. In the first of these he discusses the horse on the farm. While admitting the importance of mechanical traction in agriculture on the grand scale, he maintains that the horse is indispensable on the small or medium-sized farm.

This being so, it behoves the farmer to get the best possible mechanical return from his horse by modernizing the conditions under which the animal has to work. Awkward, uncomfortable harness and heavy, lumbering carts must all be scrapped. Experiments in Germany have proved the great advantage to be gained from the introduction of pneumatic tyres, ball bearings, and shock absorbers, and from the use of light steel vehicles which are built on rational lines and are cheaper than the old wooden farm carts. The adoption of these improvements would mean a saving of 47 per cent. of the horse's energy on a hard road and of 94 per cent. on a wet beet field, or an all-round saving of 50 per cent.

In another paper Dr. Velu deals with the horse in the city and he quotes figures compiled in Paris in 1932 which show that horse haulage is more economical than motor haulage, save in cases where the distance covered by the motor is at least twice that travelled by the horse vehicle of equal tonnage. Domestic refuse too can be collected more cheaply by horse power. In Paris it was found that the cost of removal per ton was 9 fr. when horses were used as against 26 fr. when refuse was removed in motor vehicles.

In the big American cities too, the return of the horse is becoming increasingly evident. In Philadelphia, for instance, 1,700 horses are working for the municipal cleansing department, and in New York the percentage of the total city transport which is effected by horses has recently risen from 72 to 78 per cent.

A NEW WINTER HARDY WHEAT.

The well-known Dutch plant-breeder, Dr. Mansholt, announces a new white-seeded wheat which will be capable of standing winter conditions. It was obtained by crossing Carsten V with Juliana. The new variety, which is as yet un-named, distinguished itself by the manner in which it stood up to the hard winter of 1939-40. It has the three-fold advantage of producing a heavy yield, of being winter hardy and of having a white grain. It promises to be a valuable acquisition.

The object which the breeder had in mind in the present instance was to combine the good qualities of the Juliana wheat with the quality of winter hardiness. The first crossing dates from 1932. Both parent plants have a dense compressed ear and the new variety also exhibits this characteristic which, it seems, is now considered to be rather old-fashioned. It is the

French wheats, which are often productive and are distinguished for their smaller, looser ear and abundant tillering, which have come to the fore in recent years, and their character will be plainly observed in the new varieties which will come on the market in the near future.

During the three years following the first crossing of the Mansholt wheat, no selection was made, but in the autumn of 1935, the seed of several plants was planted in a separate plot. One plot has now been reproduced on a larger scale and side by side with it a couple of other strains with somewhat different qualities have been grown.

The winter hardiness of the new variety in this larger test was not exactly that of Carsten V but must be considered to be very satisfactory in view of the severity of the winter. This it is which has encouraged Dr. Mansholt to begin growing the new wheat on a large scale. At present, one or two variations may occur in the crop, but this condition will, he believes, improve gradually year by year.

POTATOES IN PALESTINE.

The Palestine Department of Agriculture and Fisheries states that potatoes are rapidly becoming one of the most important crops of the country, and liftings—especially on the coastal plain—were very heavy from the winter, spring, and autumn sown crops. Palestine is not, however, yet able to meet the demand for local consumption and imports are still necessary. It is confidently estimated that the area of 2,357 acres planted with potatoes in 1937 has been increased during the 1938-39 season by at least 20 per cent. the total yield being computed at about 11,780 tons as against 8,820 tons in the preceding year. Trial shipments of new potatoes to the United Kingdom during winter months have given promising results.

CONTENTS.

HARVESTING AND DISPOSAL OF GRAIN CROPS.

Broadcast from Radio Eireann on Tuesday, 26th August, 1941.

by

THE MINISTER FOR AGRICULTURE.

First of all I want to say that the farmers have done a magnificent job. In these 26 Counties they have given us the largest crop of wheat since 1846. I believe we can now assume an average yield for cereal and root crops. If we get this average yield we shall this year have produced through tillage the largest amount of food on record. Having made those two very definite and positive assertions, I think I am justified in saying that no class in the community has served the community better than the farmers We asked for food and they gave it to us.

While there have been the usual cases here and there of lodging of crops, I think that on the whole the harvest is promising. A fair yield may be expected from the 491,000 acres sown under wheat, but the condition of the grain will depend on the weather of the next few weeks. Even if all the wheat is well saved, we shall not have enough to provide us with a year's bread and the seed required for next year's crop. Getting enough wheat from abroad to make good the deficiency may not be possible and it will, therefore, be necessary to hold, as a reserve for human food, a considerable proportion of the produce of the 169,000 acres under barley. This reserve, together with the barley bought for malting, will, I am afraid, absorb nearly all that comes on the market, and for this reason licences for the purchase of barley from growers will have to be restricted to the maltsters and other merchants who have been engaged extensively in the purchase of barley in previous seasons. Feeders of live stock will be dependent mainly on oats in the next twelve months. While some 778,000 acres of oats have been grown, there will be a heavy demand on the proportion of the crop that is marketed. It is necessary to ensure first that the oatmeal millers will obtain their requirements for the production of oatmeal for human food and then that there will be an equitable distribution of oats at reasonable prices to feeders of live stock, including owners of horses in towns.

The Emergency Powers (Cereals) Order which I signed on the 15th August will I hope, ensure that the produce of this year's grain crop will be utilised to the best advantage for the benefit of the whole community. To prevent speculation in grain, such as occurred last season, the Order restricts dealing in grain to licensed buyers and fixes the prices which these buyers must pay to the growers and those at which they may resell the grain. I want to make it clear that the licensed

buyers may not dispose of the grain as they wish, either by selling it or by grinding it in their own mills. In the case of wheat, the licensed millers will be authorised to mill their home-grown wheat quotas into flour or wheaten meal and dealers will be required to sell only to licensed millers and, as dar as practicable, only to those millers whose premises are nearest to them. As I have mentioned already, barley will be purchased, dried and stored by those who have been accustomed to handle this grain in the past. Licences to purchase oats from growers are being issued to merchants who have suitable storage accommodation, and those merchants will also be required to hold this grain until they receive directions as to its disposal.

To advise and assist me in arranging for the distribution of barley and oats, a Committee called the Cereals Distribution Committee, representative of the various interests concerned, has been appointed, and this Committee will direct authorised buyers when and where to dispose of barley and oats.

Listeners will probably all have seen the notice published in the daily press on the Tuesday of last week, setting out in detail the prices at which licensed buyers must purchase and sell wheat, barley and oats. Prices for wheat to the grower are minimum prices and, while the minimum price of good wheat is 40/-, a miller or dealer purchasing from the grower is at liberty to pay more than 40/-. I understand that the flour millers have, in fact, agreed to supply free sacks and to pay 40/- on the farm, while farmers who deliver their wheat will receive prices from 40/6d. to 41/-, according to the distance of the miller's premises from the farm. For wheat delivered after the 31st of December 1/- per barrel will be paid in addition to those just mentioned. I hope I shall not hear again either through malice or ignorance the statement that the Government broke faith with the farmers by depriving them of 6d. per barrel or the cost of delivering their wheat to purchasers' premises. I would like to remind wheat growers that every available barrel of wheat will be needed for human food and that it is an offence to use wheat for the feeding of animals. No farmer, therefore, should keep back any of his wheat for this purpose. He should sell all his mill-able wheat apart from what he requires for seed or for the use of himself and his family.

The price to be paid to growers for barley purchased for malting is 30/- and for all other barley of good average quality 28/- per barrel. The price for oats is 18/8d. per barrel. In the case of barley and oats the prices are fixed, not minimum, and are for grain delivered to buyer's store or railway station. These prices are for grain sold up to the end of this year, after which somewhat higher prices will be payable, as set out in the Order, but neither growers nor dealers will be able to sell grain late in the season at disproportionately high prices, such as those ruling during the past few months.

The Order provides that farmers may buy grain from one another for sowing on their own land. Farmers, owners of horses and persons in charge of horses or other animals, such as managers of racing establishments, may also purchase

oats directly from growers. Shop-keepers who buy small quantities of oats from growers, not exceeding 5 cwt. at any one time, and who sell the oats retail to poultry keepers, horse owners, &c., may also carry on their business without a licence but all other classes of persons are prohibited from purchasing grain from growers unless they have received a licence or a permit from the Minister for Agriculture. The Emergency Powers Act provides for severe penalties, including heavy fines and imprisonment, for breaches of the Order, and it is my intention to press for heavy penalties in any case in which it will be necessary to institute proceedings under the Order. As soon as possible ex-mill prices for feeding stuffs will be announced.

By this time licences should be in the hands of all those persons who have made application and whom it has been decided to authorise to purchase grain from growers. These licences apply only to grain intended for resale. Special arrangements are being made for the assembly of stocks of wheat, barley and oats for seed, and persons desiring to assemble such stocks should apply at once, if they have not already done so, to the Department of Agriculture, for the necessary permits, for which no fee is payable.

There has been considerable discussion recently regarding the lack of coal for threshing. I can hold out no hope that any coal will be available for this purpose beyond the small supply which, it is hoped, threshing owners can obtain for starting purposes and movement from farm to farm. Farmers intending to employ steam threshing sets should, therefore, immediately provide themselves with good black turf or with timber, preferably hard woods such as beech or ash. I know that those fuels have been used before. It is obvious, therefore, that they can be used again. They must needs be used this year. Much time and sympathy has been given to this question by the Minister for Supplies and myself and, indeed, by every member of the Government. I know the farmers have produced the grain that is badly needed and that the present weather will make threshing difficult even with a good engine using efficient fuel. We all agree that an ample supply of good coal would be preferable but that supply is not available. There is no use in creating a fool's paradise by telling producers they will get coal. It is better for them to face the hard and unpleasant fact now. Let us not waste further time and energy in talking of the darger and inefficiency of turf or wood for this purpose but immediately get a supply ready for threshing day. The suggestion that the Army should help in harvesting operations has come from more than one quarter. For various reasons this cannot be arranged. Farmers must this year depend on themselves, their families and employees as they have done in the past.

As a last word, I would remind farmers that, owing to the shortage of manures, we cannot hope to obtain as good a yield of cereal crops in 1942 as we have been accustomed to in recent years. It is, therefore, of the greatest importance that every farmer should grow more wheat in the coming season. No time should be lost in preparing the land for the sowing of winter wheat to the greatest

possible extent. Early sown winter wheat is certain to succeed and will yield better than the later sown crops. I hope to announce a maximum price for seed wheat in the very near future. In these times of stress especially the farmer cannot afford to rest on his oars. Before he has disposed of this year's crop he must prepare for next year. The community's needs will be at least as great, his difficulties will probably be greater. He can to some extent offset those added difficulties by planning to till more and by putting his plans into operation as soon as possible.

FOOD PRODUCTION IN THE EMERGENCY

BROADCAST TALKS

The text of the first three of this series of Talks was given in the previous number of the JOURNAL. *In the present number the text of the remaining Talks is included.*

(4) Broadcast Talk entitled "MAKING THE MOST OF THE GARDEN AND ALLOTMENT," given by MR. A. TURNER, B.Sc., A.R.C.Sc.I., Inspector, Department of Agriculture, on 27th January, 1941.

This short talk is in the nature of an appeal to the amateur gardener, the cottager and the allotment holder, whose responsibility in the matter of food production has already been referred to by the Minister for Agriculture and which cannot be over-emphasised, in view of the difficult times which may lie ahead of us all.

There are thousands of small gardens in this country. These, if viewed separately in terms of acreage, may appear insignificant and of little importance as food producing units in this time of emergency. Taken collectively they are capable of contributing very appreciably to the nation's supply of health-giving vegetables and fruit. For instance, there are over 50,000 cottage holdings of one acre or less in area, and it is obvious that if these were devoted largely to the production of potatoes and vegetables, thousands of tons of food would be produced in the aggregate. This point is mentioned to stress the fact that relatively the cottier can play his part just as effectively as the large farmer.

Many of these cottage plots are models of what they should be, and produce to the fullest possible extent food of one kind or another, but others are left uncultivated, almost useless to their owners and the nation. At any time this neglect is regrettable, but in times of emergency it is a serious matter.

The person who produces vegetables in his own garden or allotment is naturally more independent than one who has to rely on outside sources of supply. It is not taking too narrow a view of the situation to state that the householder who neglects in these times to cultivate his garden culpably exposes his family to the possibility of greater risk of suffering, should an emergency arise.

A good supply of vegetables in the home garden is an insurance against want, and is a personal economy especially when food tends to be dear and difficult to obtain.

There is no doubt that it will be necessary to accustom ourselves to a restricted range of food products. Imported fruits and vegetables, to which we have had access at all times of the year, will certainly be scarce, and must be replaced by other commodities which we can grow at home.

A diet need not be elaborate in order to supply the essentials required by the body, but it must be varied and palatable, and it is in this connection that vegetables and fruit are of special value. Carrots, Parsnips, Beetroot and Onions are (like Potatoes) energy providers. Peas and Beans provide protein material, that is to say, body building material, and all vegetables and fruits are sources of mineral salts, such as Calcium, Phosphorus and Iron, which are essential items in our nutrition.

The provision of a variety of vegetables at all seasons of the year presents no serious problem ; Cabbages, Brussels Sprouts, Brocolli, Leeks and Parsnips are sufficiently hardy to stand severe weather and may be used from the garden as required. Others such as potatoes, onions, beet, carrots, etc., can with little inconvenience be stored for use during periods when fresh vegetables are not obtainable.

The growing of vegetables presents no particular difficulty in any ordinary soil. Amateur gardeners usually concentrate on the production of the more easily cultivated kinds, such as Potatoes, Cabbages, Lettuces, Parsnips and Onions. These are indeed the most important, in fact in present circumstances potatoes should occupy the bulk of the space available. There is however no reason why, even without previous experience, a small supply of the less common sorts such as Celery, Peas, etc., could not be successfully grown.

Even if cultural mistakes are made at the outset, this need not deter the amateur, who will soon gain experience and " get the knack " of doing things correctly. In gardening greater knowledge is very often accumulated through mistakes made, than by successes achieved.

The immediate question is, what can be done now to ensure a supply of vegetables throughout the year.

First of all—plan ahead and start making preparations at once. Dig over the soil as soon as possible and add farm yard manure to at least a portion of the plot as digging proceeds, or, as a substitute, dig in rough grass, leaves or decayed weeds. And by the way, quite useful manure can be produced by allowing grass, weeds, and other plant refuse to rot in a pit or heap, so as to form what is called a compost. This will resemble soil in appearance and is very useful in the garden when other manure is scarce.

If rubbish is burned at any time, the ashes should be spread over the soil. They will provide a certain amount of Potash, which is most valuable and now almost unobtainable.

Gardeners near the sea will surely be wise enough to use sea-weed, which is also rich in Potash, and other valuable minerals. Poultry manure is also good and should be secured where possible.

In digging a grass plot do not remove the sod but chop it up and bury it as digging proceeds. It will decay and enrich the soil.

The next step is to procure a supply of the necessary seeds. Many kinds of garden seeds will be scarce and dear this year. Supplies should therefore be ordered at once and stored in a dry place until required. Do not order more than you actually require and do not waste what you do buy. Nearly everybody sows seed far too thickly and satisfactory crops could be obtained with much less seed than is generally used. By sowing seeds of vegetables in clumps of three or four at the proper distance apart, instead of in a continuous line, a great saving will be effected.

Farmyard manure is the best fertiliser but if it is not available endeavour to procure a small supply of artificial manure and store it in readiness for use as required. What has been said about seeds applies here also. Supplies will be limited ; don't buy more than you require. Store it in a dry place, and use it economically.

As soon as growth begins in February, Cabbage plants of a suitable variety should be obtained and planted out 12 to 15 inches apart. When these get established they can be hurried along with a stimulant such as Sulphate of Ammonia or Nitro-chalk. Care should be used in the application of these chemical manures—a little and often should be the rule. Heavy doses may do more harm than good. They are also wasteful as there is a limit to the amount the plant can absorb and the surplus will probably be washed away before the plant roots have a chance to avail of it.

Don't forget to put in a few rows of early potatoes. Grow some late ones too if you have room, but the early varieties can be planted as soon as the ground is in good condition in March and will mature in June and July—the months in which our food supplies may be at their lowest ebb.

It would be well to procure seed potatoes now, along with the other garden seeds. Place the tubers in a shallow box, in a well lighted but frost proof shed so that sprouting can take place before planting. In this way a heavier crop will be obtained.

Select varieties like Epicure, Sharpes Express, Duke of York, and buy certified seed if you can—it will pay you. After the potatoes are dug, plant up immediately with vegetables for winter use, cabbage Savoys, Kale, Leeks, Celery and Lettuces. You can either buy plants of these vegetables or raise them from seed yourself, but to go into details regarding the methods of raising and planting them is not feasible in a short talk of this kind. Reference to them however illustrates the important point, that a garden can, and should be utilised to produce a succession of vegetables throughout the year.

Early in March, Broad Beans and hardy varieties of Peas should be sown, and so on with the various vegetables in their season.

To keep yourself right, obtain a copy of Leaflet No. 36 " The Vegetable Garden" issued free by the Department of Agriculture.

Residents in rural areas can secure, free of charge the advice and assistance of the Instructor in Horticulture employed by their Committee of Agriculture.

Vegetables are not without their enemies. Slugs, insects and fungus diseases may be expected to do some damage, but where close attention can be given as in the case in a small garden or allotment the control of pests does not present a serious problem.

A copy of leaflet No. 101 " Diseases and Pests of Vegetable Crops " should be obtained in good time and studied carefully.

And now a word about fruit. What has been said regarding the nutritional value of vegetables, applies equally to fruit, and here again we must make the most of what we can produce at home.

It is unlikely, that foreign apples will be obtainable next Winter, but fortunately for us the Irish apple, if properly grown is the finest to be had anywhere. It must of course, *be properly grown*, and it does not matter whether you have only a few trees or a small orchard you should see that the maximum yield is obtained this year.

Thin out the branches if the trees are overcrowded and spray early in February with one or other of the well-known Tar-distillate sprays. Used at the proper strength these will cleanse the trees and will kill the eggs of many insect pests.

Later on it will be necessary to spray several times with another preparation to control Apple Scab (or Black Spot as it is sometimes called) a disease which makes the fruit very unsightly and reduces its value. Advice on this matter is contained in the Department's Leaflet No. 84.

Those whose gardens contain even a small number of bush fruits such as gooseberries and Black Currants should give them some extra attention to ensure a good crop. Pruning manuring, and spraying are all necessary. These fruits together with others such as Raspberries, Strawberries, Loganberries and Plums are invaluable to the housewife in normal times, and may be even more acceptable in the near future when other food commodities will be difficult to procure. The surplus fruit can be preserved by bottling, and thus a good store can be made available for future use.

To those listeners who have never taken a practical interest in gardening,

I would venture to suggest now that you resolve to take an active part in the planning and development of your garden or allotment. You will not have any regrets. Apart altogether from the fact that gardening is a healthy and interesting occupation and amply repays for the time and thought given to it, you will have the satisfaction of knowing that, not only are you helping to meet the vital needs of your own family, but also that you are assisting very materially in bringing your country's drive for increased food production to a successful issue.

OVERCOMING PRESENT DIFFICULTIES IN THE FEEDING OF FARM STOCK.

(5) Broadcast Talk entitled "OVERCOMING PRESENT DIFFICULTIES IN THE FEEDING OF FARM STOCK" given by PROFESSOR E. J. SHEEHY, D.Sc., F.R.C.Sc.I., Animal Nutrition Department, University College, Dublin, on 3rd February, 1941.

To our farmers one of the consequences of isolation is the cessation of supplies of maize and oil cakes which were so freely obtainable prior to the war. This creates many difficulties in the feeding of farm stock. The chief problems are (1) the procuring of sufficient animal food from our own resources and (2) the provision of a dietary which will be suitable for the maintenance of good health and production. For this present season it is clear that we shall have to do the best we can with what we have got. Immediate steps should be taken to carefully conserve what food stores there are in the haggards, barns and pits and to prevent waste in the feeding of them.

Hay should now be credited with a greater food value than formerly and it is imperative to prevent loss of it resulting from exposure to rain or wind, or from careless handling, or from feeding to excess. Feeding a large quantity so that stock have some in front of them at all times is definitely wasteful. Animals actually do better when a reasonable allowance is presented to them in a number of feeds per day and a rick of hay thus fed goes very much further. It is not fully realised that 2 cwt. of very good hay has the same feeding value as 1 cwt. barley but that when the hay is of bad quality 4 cwts. are necessary to provide the same amount of nutriment. Every effort should, therefore, be made in the forthcoming summer to save superior quality hay, which is made by cutting early and putting up without undue exposure to weather. An all-round improvement in the quality of hay would go as far towards solving the feeding problems of the 1941-42 season as any other single factor.

In the feeding of roots, better results, per pound fed, are obtained when the animal receives a moderate rather than an excessive quantity. A couple of stones daily to yearlings and four to five stones to fattening cattle and milch cows are reasonable quantities. As in the case of hay, excessive feeding and waste now, will mean scarcity in March and April.

By making the most of what hay, edible straw and roots there are farmers can spare corn and the other concentrates which have become so scarce. There is another foodstuff, which for the purpose of saving concentrates deserves very special mention, I refer to ensiled green material. The feeding of grain or meal

or cake to stores, fattening cattle, and dairy cows can be entirely dispensed with if sufficient good quality silage is available. Sheep too relish it and for sows and fattening pigs a little of it is very useful. Properly made silage is comparable in feeding value to the green material from which it is made and all farmers can fully realise the advantage of making summer grass available to stock in winter.

The necessity for every farmer to preserve in the green condition some summer grass for feeding in winter cannot be over-emphasised, and a store of silage on every farm will go a very long way to meet the needs of the 1941-42 season. Every year a considerable amount of surplus grass goes to waste in summer, and if the pastures are efficiently managed the removal of herbage for silage making at the time of peak growth does not reduce the stock carrying capacity for the season. Besides in the case of cattle which are to be kept over the 1941-42 winter it is a mistake to feed them to fatness on an over-abundance of grass in summer, and to compel them to live on their own flesh in the succeeding winter. Such treatment is definitely very wasteful of food which in time of crisis is little short of criminal. Forty pounds of silage is a fair daily allowance for a big animal and this quantity can be accommodated in 1 cubic foot of silo space.

A general feature of animal feeding is the special ability of cattle and sheep to deal with what might be described as the coarse bulky feeding stuffs—what Americans call roughages. This should be exploited to the fullest in present circumstances so as to spare the concentrated foods particularly the cereals for other types of stock.

In the way of concentrates there is, in addition to the unused residue of imported maize and cakes and home grain, a limited output from our mills. Bran and pollard which are scarce as well as dear should as far as possible be reserved for pigs and poultry. It's a long "cry" to next September, and unlike other stock, pigs and poultry cannot survive on the produce of pasture land. Bearing this fact in mind feeders of cattle and sheep should utilise all the available supplies of such foods as molassed beet pulp, dried grains and malt combings. The three foods mentioned may be dry-mixed in with other materials. Any surplus of molassed beet pulp in the factories should be immediately distributed, and feeders are advised that in pulp they have an article which, when fed dry, has the same feeding value as crushed oats. Young cattle may be given a quarter of a stone and fattening stock and dairy cows half a stone of it daily. Mixed with a little oats and perhaps dried grains or malt combings it makes a very palatable and useful food for sheep. Now that oil cakes are scarce the quantity of them fed to cattle must be very considerably reduced—a proportion of 1 part of cake or meat meal to 10 parts of a combination of such foods as oats and molassed beet pulp will give quite good results with young and fattening stock. Dairy cows giving a moderate yield derive siufficient protein from a proportion of 1 part of cake or meat meal to 6 parts of a mixture of oats, sugar pulp and dried grains. A home-grown foodstuff which could be used to entirely replace oil cakes is the

field bean a crop which can be freely grown and which gives good yields in all parts of this country. There is still time to plant this crop. Where silage is available the high protein foods, i.e., cakes etc., may be very considerably reduced in quantity or deleted entirely. Under no circumstances should any kind of edible by-product be wasted.

Year after year many of our people make the mistake of exhausting all their supplies of cattle foodstuffs before the mildness of spring starts the new season's grass. Then while waiting for the grass, there is the usual rush for purchased foodstuffs, and, as soon as the pasture sends up its young laxative spring growth the weak cattle are turned out to live exclusively on it. The consequences are serious and often disastrous. The value of the pasture for the grazing season is considerably reduced, and the hungry stock develop a virulent diarrhoea to which they frequently succumb. This year purchased foodstuffs will not be obtainable in spring and special effort should be made to economise with the existing supplies so as to stretch them out as far as possible.

The feeding of pigs and poultry in present conditions is particularly difficult. Oats finely ground can be introduced into the dietary of bonhams at a young age and it may be fed to pigs over 3½ months old in the rolled or bruised form to the extent of one third of the daily ration. Molassed pulp is useful in the food of pigs from the bonham stage onwards but it must be restricted to one sixth of the dietary mixture. The same ration must not, however, contain the maximum amount of both oats and pulp because the two together make a mixture which is too bulky for pigs other than dry sows. Barley is of course an ideal pig food and feeders who have a sufficiency of it have little worries. It may comprise up to three-quarters of the entire feed mixture. In feeding value it is the equivalent of maize which it can replace for all purposes. For that reason each individual farmer who is in a position to do so should grow sufficient barley this year to replace all the maize previously purchased. Barley in sufficient quantity for stock feeding should be grown on every arable farm this year. To supply the proteins and minerals which are necessary to make up an efficient mixture for pigs and poultry, milk is the best of all foods. The same purpose is served by fish and meat meal which in times of scarcity like this may with confidence be limited to 5 per cent. of the dietary.

Intentionally I have, to this stage, withheld mention of the potato for pig and poultry feeding. It has been demonstrated in this country that about two thirds of the meal ration of fattening pigs may be replaced by boiled potatoes without appreciably altering the amount of nutriment taken in. Thus a big pig which would consume 6½ pounds of meal daily may be limited to 2½ pounds of meals, the remaining 4 pounds being replaced by potatoes of which the quantity necessary for the purpose is 16 lb. A pig cannot consume this quantity in the usual two feeds per day. To enable even a 2 cwt. animal to consume 16 pounds of potatoes daily with 2½ pounds of meal several feeds must be given, or alternat-

ively the potatoes in the dry form, i.e. as taken out of the boiler, must be before the pig at all times. In some of the literature this latter method of feeding pigs is spoken of as the Lehman system, but it could be as appropriately described as an Irish system. When our small pig producer mixes a large tub of boiled potatoes or bruised cabbage with a handful of meal he prepares the same kind of feed as Lehman is credited with discovering. For the guidance of those who give wet feeding and who wish to give the maximum of potatoes the proportion by weight of potatoes and meal for the respective ages is as follows :—

At the age of		10	weeks	Equal parts.			
,,	,,	16	,,	3 parts potatoes	to	1	of meals.
,,	,,	22	,,	5 ,,	,,	1	,,
,,	,,	26	,,	8 ,,	,,	1	,,

The proportion of potatoes would be gradually increased throughout the entire period. Boiled turnips or cabbage may be used to partly replace the potatoes. At no stage in his life can a pig consuming ad lib. the above mixture eat more than 2 to 2½ pounds of meal per day to which figure the allowance of meals given daily may be limited when the ad lib. feeding of potatoes in the dry condition is practised. To a lesser extent the potato may be used to replace the meals for poultry.

One of the many ways of solving the 1941-42 feeding stuff problem is to grow a very much extended area of potatoes for feeding to pigs and poultry. Potatoes ordinarily kept depreciate rapidly from this period of the year onwards but fortunately they can be preserved without further wastage by ensiling. The tubers to be ensiled are boiled and placed in a pit and covered so as to exclude air.

The absence of maize removes from the food menu of pigs and poultry a nutritive factor known as Vitamin A which is not supplied by any of our own cereals. Because of the lack of Vitamin A young pigs or poultry fed exclusively on such an apparently good dietary as a mixture of bran, pollard, potatoes, barley, oats and meat meal make poor progress and return a loss for their keep. Actually a batch of chickens so fed all die in 5 or 6 weeks for the same reason. Luckily this essential food ingredient is found in considerable quantity in pasture herbage, in cabbage, kale, rape, green vetches, green cereals, rye grass and all green vegetables so that we in this country need not be at a loss for it. Green feeding is also rich in proteins and valuable minerals and for the purpose of balancing up rations for pigs and poultry both in respect of these ingredients and of Vitamin A it is the most important foodstuff. Arrangements should, therefore, be made to make it available in quantity up to December next and again from April, 1942 onwards. For the dead period of January to March feeders should procure a supply of grass meal which serves the same purpose as green feed and which is now made here at home in fair quantity.

In this national emergency the human being is calling for more food production

in the form of a vast increase in wheat acreage. Farm stock, by their very presence are calling similarly. For them a very considerable increase in the supply of feeding stuffs for next season is essential. I have indicated the lines along which increased production of stock foods should take place. It is the combined privilege and responsibility of each individual landholder to make his maximum contribution towards a supreme national effort to save ourselves and our stock from disaster.

SUGAR BEET

(6) Broadcast Talk entitled "SUGAR BEET" given by JAMES J. GLAVIN. B.Sc., N.D.A., Chief Agricultural Adviser, The Irish Sugar Company, Limited, on 10th February, 1941.

An Taoiseach and members of the Government have informed you that there is an urgent need for increased food production and, further, that if we are to survive the present crisis we must produce, in the coming season, sufficient quantities of essential foods to feed man and beast. You were told that it is of vital importance that all the resources of farmers, cottiers, plotholders, etc. should be mobilised and utilised in increasing food production. Farmers will no doubt have already harkened to the call for increased production of wheat, potatoes, oats, barley, etc., and I say God Speed the Plough and Reward their Labours.

To-night it is my privilege to speak to you on Sugar Beet Production. In an article published in an Agricultural Journal last spring I appealed for the active support and co-operation of all beet growers in producing, not only more sugar beet, but more sugar per acre under cultivation so that we would be as near as possible to being independent of imported supplies of sugar in 1941. I take this opportunity of expressing the appreciation of the Irish Sugar Company for the excellent manner in which sugar beet growers responded to that appeal You will be very glad to know that in the season now completed over 92,000 tons of white sugar have been manufactured from home grown beet and, with that refined from imported cane, there will be sufficient to meet the total needs of the entire population up to February, 1942. In addition, 58,000 tons of Molassed Beet Pulp, the equivalent in feeding value of 58,000 tons of oats or of 48,000 tons of maize was manufactured in the four factories. This amount of dried pulp is capable of replacing to some considerable extent the shortage of imported animal foods.

The importance of sugar beet cultivation and beet sugar manufacture is often underestimated by the man in the street and for that reason I propose to give a few facts and figures for the information of listeners. Sugar beet, acre per acre, produces more human and animal food than any other crop that can be grown on the farm. As human food sugar takes sixth place in the list of staple foods having a higher food value than oatmeal, beef, bread, milk or potatoes. A statute acre of sugar beet produces on an average :

30 cwts. of white sugar—sufficient to supply 65 people with a pound of sugar each per week over a period of 12 months.

18½ cwts. of molassed beet pulp—the equivalent in feeding value of 18½ cwts. of Oats or 15½ cwts. of Maize.

9 tons of tops and crowns—the equivalent in feeding value to the produce of half a statute acre of swedes or mangels, and in addition, because of the intensive cultivation carried out in its production, greater productive capacity of the land for the following crop.

It is, therefore, no wonder that sugar beet cultivation in the present crisis is of such special significance and economic importance to the Irish people. Apart altogether from its economic value as a farm crop with a guaranteed price and an assured market, sugar beet gives that stability to agricultural production which ensures benefits of great value to the entire population. A few examples will suffice to demonstrate the magnitude of these benefits. The total payments to beet growers in 1940/41 for beet delivered was slightly under £2,000,000 of which over £230,000 was paid as cash advances during summer and early autumn. Over £390,000 was paid to the Railways and other carrying companies.

The response to the Company's appeal for increased sugar beet acreage in 1941 is excellent and the acreage applied for to date is sufficient to meet the requirements of the factories each working to full capacity. Contracts are now being issued to all applicants for acreage and growers are strongly advised to avail of every opportunity from now on to prepare their land so as to be ready to make early sowings. Beet growers should realise that the production of sugar beet in the coming season is of National importance and for that reason they should give it such special care and attention as will produce the maximum output of sugar per acre. General instructions of a very comprehensive nature regarding the production of sugar beet have been issued to all beet growers in past seasons and can be had on application to the factories by those who are cultivating the crop this year for the first time. There are, however, a few important points which deserve special attention this season and which I wish to emphasise:

The import of beet seed from the Continent was impossible during the past two seasons and consequently this year's supplies are being made from reserve stocks supplemented by home production. The quantity of seed to be supplied to each grower this year shall be at the rate of 16 lb. per statute acre. The Company are satisfied that with more careful sowing—dibbling where possible and practicable—growers should not experience any insurmountable difficulty in sowing the entire contract acreage with the seed supplied. Seed in excess of this amount will not be supplied to individual growers.

Sugar beet seed has been produced by the Sugar Company on a commercial scale in this country for the past four seasons and you will be pleased to learn that in quality and quantity it compares most favourably with best imported Continental seed. Production of beet seed in the coming season will be on such a scale as is estimated to provide our full requirements in the season 1942. Growers should not attempt to produce their own beet seed, for unlike mangels or other root crops used exclusively for animal consumption, sugar beet must be

of a standard uniform composition before it can be used for economic sugar manufacture. Sugar beet produced from seed other than that supplied by the factory may be unsuitable for sugar manufacture and consequently rejected by the factory. Beet growers would be well advised to leave beet seed production to the factory experts.

As you know, restricted shipping has severely curtailed the import of artificial manures and farmers, and particularly beet growers, should make the best possible use of all available supplies of farmyard manure and seaweed. The former is a complete fertilizer as well as a valuable source of organic material essential for beet production, while the latter of like composition contains a high percentage of Potash—a fertilizer now very difficult to procu.e. Farmyard manure should be so stored and heaped as to prevent any loss by drainage or escape of ammoniacal nitrogen. Animal urine—very rich in Potash should not be allowed to go to waste by drainage from the farmyard or manure heap; it should be absorbed by litter and thus saved for application to the land. Seaweed, as already stated is also a valuable fertilizer and particularly for sugar beet. In addition to Nitrogen Phosphates and Potash it contains salt for which sugar beet has a natural affinity. In the seaboard areas beet growers are strongly advised to utilize all available supplies of this product Regarding artificial manures normally used in beet production beet growers should apply the standard dressing as recommended in past seasons. Where such manures are not available, or where supplies do not permit of the same heavy dressing or mixtures as have been used heretofore, beet growers should not hesitate to cultivate the crop. With judicious use of available supplies and more careful attention to soil preparation, sowing, singling and after-cultivation, the effects of reduced fertilizer dressings will be offset to a very appreciable extent. While supplies of Nitrogenous and Phosphatic manures may be reasonably satisfactory supplies of Potash manures such as Kainit and Potash Salts, hitherto used in beet production, will be strictly limited. I would remind beet growers however that Potash manures are not altogether essential for beet production particularly on heavy soils or on soils which have received heavy dressings of Potash in previous seasons or on those which have received an application of farmyard manure or seaweed. The exclusion of Potash from the manurial dressing on such soils will not materially affect the crop yeild. On the other hand on light sandy soils which have been subject to heavy root cropping in previous years beet growers should apply Agricultural Salt at the rate of 4 cwt. per statute acre. It must be distinctly understood that Agricultural Salt does not contain Potash, but sugar beet because of its ancestral home on the seaboard has a natural affinity for salt. The good results obtained from the inclusion of 14 per cent or 20 per cent Kainit in the beet mixture may be attributed in no small degree to the high percentage of salt contained in such manures. Beet growers should also bear in mind that any deficiency of one particular fertilizer in the mixture cannot be made good by an increased dressing of another. Increased dressings of, say, phosphates in the absence of Potash would only tend to intensify the effects of the Potash

deficiency while increased dressings of nitrogenous manures such as Sulphate of Ammonia or Nitrate of Soda would promote the growth of more luxuriant foliage at the expense of yield and sugar content. I would strongly advise all beet growers to apply Borax at the rate of 21 lb. per statute acre as a preventive against Crown Rot, especially on soils where this disease has occurred in past seasons or which have received dressings of lime in one form or another.

Facilities extended to beet growers last season whereby they were enabled to obtain artificial manures for the crop on credit but at cash prices are being continued this year. The extent of the credit available has been increased from £3 to £4 per statute acre of beet grown under contract. Growers who wish to participate in the Scheme should get in touch with a manure merchant who will supply all the necessary particulars. I would remind all beet growers to make certain that the Government rebate of £1 per ton on the Compound Sugar Beet Manure and Superphosphate is passed on to them in full. Such rebate should apply irrespective as to whether the manures have been obtained for cash or on credit terms.

I have already referred to sugar beet seed and the quantity which will be supplied to each grower. I would advise each farmer to sow as early in April as possible, provided soil and weather conditions at that time permit the preparation of a fine and firm seed bed. Sowing may, if necessary, be continued up to the beginning of May. Early sowings are conducive to higher yields but should not be made unless the tilth is satisfactory and weather conditions favourable. The seed should be sown evenly, particular attention being given to the adjustment of the machine so as to ensure the sowing of the entire contract acreage with the seed supplied. It should be sown at a depth not exceeding ¾ inch. Too many crop failures in past seasons have been traced to careless sowings, either too shallow or too deep. Careful sowing of the seed on a well prepared seed bed will ensure an even braird of healthy vigorous growing plants, the fundamental essential for subsequent root growth and development.

The horse hoe should not be spared as soon as weeds appear but care should be exercised so as not to injure the young growing plants by either hoeing too closely or covering the seedlings with soil. Singling, or as is commonly known "thinning," should start as soon as the plants have developed four leaves. This is the most important operation of beet production and the one which has the greatest influence on the subsequent yield and sugar content. It should be performed with the greatest care possible and at the correct time. Delayed or careless singling may reduce the crop yield by as much as 5 tons of washed beet per statute acre. The correct spacing of the plants will depend on the width of the drills but the aim should be to produce a plant population of not less than 35,000 per statute acre. Growers would be well advised to leave the plants a little closer this year, particularly in cases where it has not been possible to apply the normal heavy dressing of artificials.

Horse and hand hoeings should be carried out as often as weeds make their appearance in the furrows or between the plants. Weeds use up manure, absorb moisture and check the growth of the young plants hence they should be eradicated. Besides the destruction of weeds, hoeings aerate the soil, promote conditions conducive to rapid leaf and root development, hence they should be repeated at regular intervals. I would here remind growers of the old but wise saying Sugar is Hoed into the Beet.

Unlike other crops, harvesting of sugar beet is spread out over what is commonly known as the campaign—the period during which sugar is manufactured from beet. Harvesting should be carried out during periods when soil and weather conditions are favourable for the operation. It is not practicable and neither is it profitable for the grower to harvest and deliver all the beet at one time ; the deliveries must be spread out in accordance with factory instructions so as to give each grower an opportunity of delivering part of his crop. Far too many growers delay harvesting their crops until late in the season--some even only start after Christmas. In all such cases the losses, apart altogether from the hardships, are serious for all concerned. Such hardships can be easily avoided by harvesting well in advance of the receipt of factory delivery orders.

Time does not permit me to say all I would like in regard to the supreme importance of the by-products of the sugar industry. They are very valuable, particularly in the present emergency, and beet growers should utilize them to the fullest possible extent. Tops and crowns are the equivalent in feeding value of an equal weight of swedes or mangels. The tonnage of tops remaining on a statute acre of ground after delivering, say, a 10 to 12 ton crop will provide the same quantity of animal feeding as half a statute acre of swedes. During the next autumn and winter growers should use their tops and crowns to the best possible advantage by direct and judicious feeding to stock, or in the case of large growers by making them into ensilage.

The other by-product Molassed Beet Pulp is now so generally well known and recognised as a productive and economic stock food as to require no comment In feeding value it compares favourably with oats, barley and maize and consequently is of great economic importance in present times. Beet growers who wish to obtain the maximum returns from the crop should procure every pound of this product guaranteed to them under their Contracts and use it for feeding their stock.

In conclusion I would suggest the following as maxims for all 1941 beet growers :

1. Avail of every opportunity from now on to cultivate and prepare the land intended for beet production.

2. Make the best possible use of available manures, farmyard, seaweed and artificial.

3. Sow early and uniformly on a well prepared seed bed.

4. Spread your seed supply over the entire contract acreage.

5. Single early, carefully and well, thus ensuring a uniform regular stand of strong healthy plants.

6. Keep weeds under control.

7. Horse and hand hoe Sugar into the beet—IT PAYS.

8. Harvest the crop under favourable weather conditions. Do not wait for the rainy day.

9. Do not let your tops and crowns go to waste. They are a valuable stock food.

10. Secure the full quantity of Molassed Beet Pulp guaranteed to you under your Contract.

Beet growers who adopt these simple rules will be serving the country well and their own best interests.

POULTRY KEEPING

(7) Broadcast Talk entitled "POULTRY KEEPING" by DENIS PHILPOTT, M.Sc., B.Agr.Sc., Poultry Inspector, Department of Agriculture, on 20th January, 1941.

Previous speakers in this series of talks have pointed out the necessity for increased production at the present time. The production of wheat for our population is naturally of primary importance, but almost equally important is the provision of food for livestock so as to ensure supplies of the animal products that form the food of our people : and so that our export trade in livestock and their products may be maintained.

Of all livestock none is found so widespread in this country as poultry. All over the country they are kept on specialised farms, on large farms, on small farms, and on cottage holdings whether on good or poor land. They are to be found in numbers in villages, towns, in urban and metropolitan areas, as well as in the most remote parts of the country. No other livestock can be maintained under such a variety of conditions or enter into the economy of such a number of households. This wide distribution of poultry is due to their adaptability to different conditions, and particularly to their suitability for utilising waste grain and other food on the farms, and kitchen offals in towns and cities.

As constituents of human food eggs and poultry meat are not easily replaced, while eggs especially are invaluable in the diets of invalids and children. In the diet of our people eggs figure more largely than any other foods of animal origin, save possibly dairy products : and the consumption of eggs per head of population in this country is higher than in any other country in the world In addition to supplying a considerable proportion of the diet of every rural household, the income derived from sales of eggs and poultry provides the farmers wife with the means of purchasing household necessities throughout the year, while the main income on many small farms particularly during winter comes from the sale of poultry products.

It is obvious that poultry play a vital part in the economy of this country and the ill-effects of any appreciable reduction in poultry production would be widespread. Every effort should, therefore, be made to maintain poultry stocks and the output of poultry products during the present emergency.

There are in this country at the present time flocks of the principal utility breeds of poultry second to none in the world. That this is so in the case of domestic fowls can be seen from the results of the National Egg-Laying Test

held each year at the Munster Institute, Cork. At this Test pullets from breeders all over the country are taken in, kept under identical conditions, and recorded individually for almost eleven months. The egg records put up by the birds in the National Laying Test have been for some years now higher than those in similar Tests in other countries, and more important still the mortality amongst the competing birds has been lower than that amongst birds on Tests elsewhere. The skill displayed by the more progressive poultry-keepers in this country is of a high order; and assistance in solving the numerous problems encountered by poultry-keepers is given by the Poultry Instructors who are well qualified to render such assistance. The soil and climate in all parts of the country are eminently suitable for poultry-keeping. All the factors necessary for carrying on poultry-keeping are to be found in the country.

A factor has arisen, however, which may interfere seriously with poultry production. I refer to the difficulty under existing circumstances of providing suitable food for poultry. Poultry must of necessity be fed on fairly refined and concentrated foods. Imported maize as grain or meal has heretofore comprised a large proportion of the rations of all kinds of poultry. The by-products of the flour milling industry—bran and pollard—have likewise formed in the past the greater part of all poultry mashes. Imports of maize have ceased, and as has been publicly stated many times recently, there is no hope whatever that they will be resumed in the near future. The supplies of bran and pollard available for poultry feeding for the next six or seven months at any rate will be negligible, due to the higher proportion of the wheat grain now included in flour. Any of the home grown cereals barley, oats, and wheat are suitable substitutes for maize, bran, or pollard. No wheat other than damaged or small wheat is available for poultry feeding, and even the amount of barley to be had is very limited. Oats must, therefore, be used to a greater extent both as meal and grain. Boiled potatoes are also a useful substitute for maize for the feeding of poultry, and any waste potatoes or tubers and peelings left over after meals may profitably be fed to poultry; particularly to adult birds. Up to half the weight of the wet mash fed to such stock may consist of potatoes, the remaining half being made up of any cereal meals available.

Kitchen offals such as pieces of bread, cooked vegetables, and minced meat scraps may with advantage be included in all poultry mashes. Raw mangels, turnips and vegetables, such as cabbage, also make useful constituents of the diet of poultry. Some difficulty may be experienced in raising chickens owing to the shortage of the foods normally fed to them. Any pollard, bran, or even maize available should be reserved for chickens. Pinhead oatmeal, and small wheat will also be very useful in the feeding of young stock.

Small amounts of protein supplements must be included in the rations of growing and laying birds. The provision of these is not so difficult even at present, for in addition to any home produced fish meal, meat and bone meal, and meat

meal available, there is on most farms a supply of separated milk or skim milk. This is the most suitable protein supplement possible for poultry, but particularly for young growing birds. Separated milk can be fed in the liquid state instead of drinking water, and can also be used in mixing wet mashes. An additional source of all the food nutrients required for poultry is provided by the vegetation, insects, worms and seed picked up from the range over which birds are allowed to run. Information regarding the feeding of poultry in present circumstances is given in Special Leaflet No. 5, " Home Produced Foods for Poultry Feeding " copies of which may be obtained free of charge from the Department of Agriculture, Dublin.

While the emergency prevails, it is inevitable that poultry-keepers will have to rely solely on home produced foods. It is fortunate that the great majority of poultry in this country are kept as a side line on general farms and, therefore, at the source of food supplies. Poultry production on such farms can be carried on as usual, and the maintenance of the output of poultry products during the emergency will rest largely on the general farmer. The prospects for poultry-keepers depending solely on purchased foods are not encouraging and unless such poultry-keepers can make provision for the production or purchase of home grown foods, they would be wise to curtail their hatching and rearing operation during the present season.

At any time, but particularly when food is scarce and high in price, poultry production can be carried on successfully and profitably only if proper methods of poultry-keeping are practised. On many general farms in this country the methods of poultry-keeping employed are far from satisfactory and are in need of improvement. Wastage of food occurs in many ways and such wastage is indefensible particularly at present when it is of the utmost importance to conserve any food available and use it to the best advantage

Maximum returns from commercial egg production can only be obtained from birds of the highest quality that are fed, managed, and housed properly. The maintenance and feeding of mongrel birds of poor quality particularly at the present time cannot be justified and it would be far wiser to give up poultry-keeping altogether than continue to keep such birds. All poultry-keepers should now endeavour to improve the quality of their poultry. Those who already keep pure-bred birds should procure additional stock of hatching eggs only from the best sources, while owners of mongrel flocks should take immediate steps to replace such stock with reliable pure-bred birds.

Hatching eggs and day old chicks from healthy pure-bred stock are available at reasonable prices at the poultry stations established in each county by the Committee of Agriculture. The facilities provided by these stations should be fully utilised and orders for hatching eggs or chicks should be placed without delay. Hatching eggs, day old chicks, and adult stock of high quality are

also to be had from a number of poultry breeders throughout the country. Poultry-keepers need not go outside this country, not even beyond their native counties to procure hatching eggs, day old chicks or adult stock of the highest quality.

In view of the facilities existing for obtaining poultry of the best utility breeds, the feeding of birds of poor quality and the raising of chicks from such stock involves a waste of food that cannot be defended particularly during the present emergency.

The poultry kept on a number of farms are not alone of poor quality but a large proportion of the birds are too old to give profitable egg production. Even pure-bred birds of good laying strain do not lay a sufficient number of eggs after their second year to enable them to be kept for commercial egg production at a profit. Hens over two years old should, therefore, never be kept except for breeding purposes ; and in fact the greater the proportion of pullets kept the higher will be the production. Amongst even the best flock of pure-bred laying pullets, there will be birds that are poor layers and such birds should be rigorously discarded. The culling of older bi ds not used for breeding and of younger unproductive birds should be carried out regularly and a considerable saving in food will thereby be secured. Culling should not be confined to older birds but should be a routine practice from hatching onwards. Weakly and unthrifty chickens and growing stock should be discarded or disposed of and only the best developed and most promising pullets should be retained. Such methodical culling would have a beneficial effect not only on the returns from poultry-keeping, but also on the health of the poultry in the country. Instruction and demonstrations on culling and on the methods of identifying unproductive and unhealthy birds may be obtained from the Poultry Instructors.

Apart from the wastage of food involved in feeding birds of poor quality, unproductive and unhealthy birds, considerable waste of food occurs where careless feeding methods are practised. Under the conditions obtaining on many farms where suitable food hoppers are not provided there is invariably loss of food, especially with chickens, owing to scattering of dry mash on the floors of poultry houses or on poultry runs. The more general use of wet mash feeding is, therefore, recommended at present as it is less wasteful than dry mash feeding and moreover it facilitates the utilisation of cooked potatoes and kitchen offals. Feeding in the open by throwing grain or mash on the ground outside the poultry house is not only wasteful but also likely to spread disease ; and the scattering of grain in the litter in poultry houses sepecially when the litter is not kept perfectly clean is objectionable for the same reason.

The management of young and adult poultry is of the utmost importance particularly at the present time. In recent years indoor or intensive methods of brooding chickens have supplanted older methods of brooding on most farms, and even intensive methods of keeping laying birds have been adopted in some

places. These methods which may be feasible in normal times are not practicable in existing circumstances, as it is not possible to provide the complete rations required by birds kept under such conditions. The value of clean range for the development and health of poultry has long been recognised, and outdoor methods of brooding, rearing, and management should be employed to the greatest possible extent. A good range also provides much supplementary food in the form of insects, worms, seeds and even young grass and clover. The provision of ample range for poultry should be no problem to the majority of poultry keepers in this country, yet although on many farms ample land is available, poultry are constantly confined to small areas or to the farm yard, and thereby subjected to all the disadvantages of such highly intensive and insanitary conditions.

The immediate concern of poultry keepers is the conservation of any poultry food available and its utilisation to the best advantage, so that poultry flocks may be maintained and sufficient young stock raised during the present season. It is also imperative that poultry keepers should make every effort and use every influence to ensure that adequate food for poultry will be available after next harvest. The poultry industry of this country has been successfully developed and is carried on mainly by women, and it is for them to ensure that the needs of poultry receive special attention when the increased tillage programme is planned. It is probable that all the millable wheat of next season's crop will be required for human consumption, but some small wheat will be available for poultry feeding on farms where wheat is grown. After next harvest poultry will however have to depend mainly on home grown cereals other than wheat, and on potatoes. The women folk on the farm should, therefore, encourage increased production not only of wheat, but also of oats, barley and potatoes. It is only if abundance of produce from these crops is available that the poultry industry will survive.

THE CULTIVATION OF OATS.

(8) Broadcast Talk entitled "THE CULTIVATION OF OATS," given by PROFESSOR M. CAFFREY, Head of Plant Breeding Division, University College, Dublin, on 24th February, 1941.

During recent months an intensive publicity campaign has been undertaken in favour of increased wheat production. We know what the position is at present. We are becoming familiar with the ninety per cent. loaf. We have been made aware that wheat flour will be scarce during the months of July and August. Finally, we have it on the authority of the Department of Agriculture that it will be necessary to grow during the present season not less than 650,000 acres of wheat, if our bread supplies are to be adequately ensured from the harvest of this year to the harvest of 1942. The wheat portion has been made plain and the farmer's responsibility in this regard clearly indicated.

The growing of this area under wheat will, however, solve but one of the many food problems which the present crisis has imposed upon our people. We have to provide for our flocks and herds and to make good, by the most efficient use of the inherent fertility of our soils, the loss in feeding stuffs occasioned by the stoppage of maize, wheat offals and concentrated cakes which previously we were wont to import in such large quantities. This can only be done by increased tillage, for land under tillage in Ireland is capable of producing between two and three times as much food as land of equivalent fertility under grass. What is needed therefore is not only more wheat, but also more potatoes, more barley, more roots, more oats, and also the better utilization of our pasture and meadow lands.

Some of these matters have already been dealt with by previous speakers in this series. It is my task to-night to deal with the production of oats. I do this with much satisfaction because oats is a particularly suitable and valuable crop to recommend to the attention of Irish farmers especially in times of emergency. The oat crop is as suitable for cultivation in Ireland as is potatoes. It has always been widely grown here and farmers understand its cultivation, manuring and harvesting better than that of any of the other cereals It yields well and both the grain and the straw are desirable feeding stuffs As a cereal food its importance in this country is second only to that of wheat. It would, I presume, be in the interests of the public health if our people as in olden times made use, to a far greater extent than at present, of oaten porridge as an article of food. Moreover we can grow oats supremely well here. Our crops of this cereal are not surpassed, nor indeed equalled in regard to yield, quality and freedom from disease by the produce of any other country.

Oats, in addition, is an accommodating crop. It can be grown in any part of the tillage rotation. It does well after lea, after roots and potatoes, or after another cereal crop. Under existing circumstances farmers should, as far as is possible and convenient, reserve their best manured soils and also their freshly ploughed pasture lands for wheat—at least in these districts where wheat can be grown successfully—and utilize their less fertile lands for oats. Both oats and barley are comparatively reliable crops to follow another cereal, they are more resistant than wheat to attacks of the various species of soil fungi which live on the roots of cereal plants. Therefore where it is proposed to sow two cereal crops in succession on the same area of land, say, wheat and oats, or, wheat and barley, the wheat crop should always be sown in the first year and either barley or oats in the second year. When wheat follows wheat there is greater danger of damage from root-rot diseases.

Oats should be seeded during the month of March, and the optimum period of sowing would be between, say, the seventh and the twenty-fifth of thatmonth. Too early sowing is not recommended, for the oat plant is less hardy than wheat and may suffer severely from heavy frosts and harsh drying winds. Moreover, the resulting braird, unless the seed has been treated with a powder disinfectant,

may be seriously infected with "leaf stripe" disease. On the other hand, late sown crops suffer badly in certain districts from attacks of "frit fly." This insect pest attacks backward crops of oats during the month of May. Fortunately forward crops at this period—that is March sown crops—are not damaged by this parasite.

It is advisable to dress the seed before sowing with an organic mercury powder disinfectant, of which there are several efficient brands on the market. These dressings control "leaf stripe" and also preserve the young germinating plant from the attacks of other fungoid pests that may be carried on the outside of the seed. When applied as directed, namely at the rate of 2 ounces per bushel, these powders do not impair the germination capacity of the seed. For these reasons dressed seed, especially when the previous harvest was cold and wet, frequently gives a better and evener braird of established healthy plants than untreated seed.

The quantity of seed which it is advisable to sow per acre depends on many factors: the quality of the seed, the condition of the soil, the extent of possible depredations by birds, leather jacket grubs, wire worms and so on. It is always, therefore, good farming practice to ascertain and be guided by local experience in this matter. Here in Co Dublin, seed oats is drilled in at the rate of about 14 stones per statute acre (which is equivalent to 22½ stones per Irish acre) and experience has proved that this quantity is amply sufficient for clean soils in good heart. Broadcasting the seed by hand or fiddle-sower is also good farming practice. This does not give as uniform a braird as the seed-drill and more seed is required.

Some farmers who have had trouble from lodged crops are under the impression that deep sowing will, by providing a deeper rooting system, enable the crop to stand up erect to harvest. This is a delusion. The oat plant during the coures of its growth develops two distinct rooting systems, viz: the primary or seminal roots which are important only in the early stages of development, and the secondary roots which eventually form the main rooting system of the plant. These latter are produced during the tillering and shooting stages of growth and they are always formed from nodes near the surface of the soil. Deep sowing is therefore ineffective in preventing "laid" crops. Experience has shown that the only way by which lodging may be prevented on rich soils is by the selection of a stiff strawed variety and by the proper consolidation of the seed bed. It is therefore unnecessary, indeed it is inadvisable, to sow deeper than about 2½ inches, which is the proper depth for the seeding of the oat crop.

We are indeed fortunate in having now available in this country ample supplies of sound healthy seed oats, and of varieties which in respect of potential yielding capacity, grain quality, ability to resist disease attacks and strength of the straw are superior to any stocks which could be obtained from overseas. These varieties have been bred in this country. They have been adequately tested, in

quantitative experimental plots conducted over many years, against the best procurable foreign varieties and they have demonstrated their superiority over these imported varieties by margins which are statistically significant.

Moreover, the Department of Agriculture have had in operation for several years an oat propagation scheme under which large extension plots of pedigree seed of the best of these varieties are annually propagated at their Cereal Station at Ballinacurra, Co. Cork and at their Agricultural Stations at Athenry, Ballyhaise and Clonakilty. The produce of these plots is distributed annually to seedsmen, to farmers' associations and, in certain cases to farmers, with a view to having them further propagated for seed purposes.

As an example of what is being effected by efficient seed propagation and direction, the work which the Roscommon County Committee of Agriculture is now doing in this connection may be mentioned. A foundation stock of pedigree seed has been obtained each year in that county during the past four or five years from the Department of Agriculture. The County Committee makes a small contribution towards the cost of the seed, which is placed with selected growers in the best corn growing districts. During the summer the Agricultural Instructors inspect the growing crops and if approved the produce is retained for seed. In certain cases arrangements have been made to continue the propagation of outstanding stocks for as many as three successive years. I am informed that 1,800 barrels of pedigree seed were produced last season. After supplying local needs the growers had over 800 barrels available for sale and this has been disposed of to seedsmen for seed purposes.

The varieties which are being propagated in this way and which are recommended for cultivation in Ireland are as follows :—Glasnevin Ardri, Glasnevin Success, Victory 2 and Potato (Ardee).

Glasnevin Ardri has been derived from a crossing between Victory 2 and Glasnevin Sonas. In habit of growth it resembles Victory 2, it ripens as a rule about one or two days later than the latter variety. It is of very high yielding capacity on land in good heart and although the straw is of medium length it is lodging resistant to a remarkable degree. The grain is cream in colour, plump, but somewhat smaller than Victory 2. Ardri is undoubtedly the best oats now available in this country for cultivation on rich soils.

Glasnevin Success resulted from a crossing between Victory and Record. This variety is specially suited for growing in late districts or in cases where circumstances prevent the sowing of the oat crop at the optimum period. It ripens five or six days earlier than Ardri. The straw is very short and strong, the tillering capacity is high. The grain is white in colour, very large, but inclined to have a higher proportion of infertile grains than is desirable.

Victory 2 is the result of a single plant selection made from a hybrid stock

obtained from Svalof, Sweden, in the autumn of 1920. It has been for many years the leading oat variety in this country. It is definitely inferior in yielding capacity and in strength of straw to Ardri and Success on rich soils. On soils of average or less than average fertility, as, for example, in those areas where barley is widely grown, there is perhaps no variety quite as reliable. The grain is cream in colour, plump, and of high bushel weight.

Potato (Ardee).—This is a very distinctive and indeed remarkable strain of Potato oats. It ripens early, produces a very well filled, white plump grain and yields well. Its most striking feature is, however, its capacity to resist lodging. During the many years in which pedigree stocks of this particular variety have been grown at Glasnevin it has never shown any tendency to become "laid" at harvest, and invariably our field plots of Potato (Ardee) have been cut on all four sides with the binder. Growers in districts where Potato oats are widely grown should endeavour to obtain stocks of this particular strain.

There is fortunately no necessity to recommend any foreign oat varieties to the attention of Irish farmers None of them are as good for general cultivation as the varieties which have been referred to. Neither is there any necessity to recommend any variety of black oats. Previously, the propagation of Black Tartary oats might have been recommended because of its reliability and ability to do well on all classes of soil. Now, however, the white oat varieties bred here are at least as reliable as Tartary, and far more productive in respect of both grain and straw.

In view of the unfavourable weather conditions during the past month and the consequent hold-up in the sowing of winter wheat, it has been suggested that I should avail of this opportunity to say a few words regarding the practicability of sowing winter varieties at this date.

1. It is now too late to sow Pajbjerg, Steel, Scandia and all other Danish and Swedish winter wheat varieties.

2. **Squarehead Master, Queen Wilhelmina, Double White Stand Up, Juliana, Wilma** and **Fenland Wonder** may be sown up to the end of this week, and if normal weather conditions prevail the resulting crops may be expected to ripen before the end of August. In the event, however, of an unfavourable growing season harvesting may be delayed until the first or second week in September. It may be that a farmer or grain merchant has a stock of wheat the variety of which is unknown to him. If that stock is white in colour of grain it is almost certain to be of the Wilhelmina type and may be sown up to the end of this month.

3. **Yeoman or Yeoman 2** may be sown up to the 3rd or 4th of March. After this date it is risky to sow any purely winter wheat variety.

4. **Desprez** may be sown with safety up to the middle of March. There are small stocks of this variety still on the market; owing to its short straw Desprez is very suitable for cultivation on heavy land.

5. **Red Marvel** can be sown up to the end of March provided that genuine seed is available. Farmers need scarcely be reminded of the losses caused in recent years from the use of spurious imported stocks sold as Red Marvel —stocks comprised of a mixture of spring and winter types. They should use seed from home-grown crops which were sown last spring and which ripened satisfactorily and evenly before the end of August. Failing this source of supply they should go to a reliable seedsman and obtain a guarantee as to the genuineness of the seed supplied.

It should be mentioned that these precautions apply only to Red Marvel and not to genuine spring varieties such as April Bearded Diamant, Atle, etc., which may be sown during the next six weeks.

(Issued as Special Leaflet No. 16).

MORE AND MORE POTATOES

(9) Broadcast Talk entitled "MORE AND MORE POTATOES" given by MR. D. DELANEY, Inspector, Department of Agriculture, on 3rd March, 1941.

In a recent talk from this Station Dr. Kennedy of the Irish Agricultural Organisation Society drew attention to the importance of the potato crop in the present emergency and dwelt at some length on its high feeding value for both man and beast. I propose in this talk to deal with other aspects of the subject, namely, the measures which should be adopted in present circumstances to secure the maximum yield per acre or as indicated in the title of this talk to produce "more and more potatoes." Farmers throughout the country are not unaware of the feeding value of a given quantity of potatoes whether that quantity be measured in cwts. or tons. What they do not appreciate is that the yield they usually obtain could be doubled or trebled or in other words that the average of six or seven tons per acre could, with proper attention, be increased to fourteen or sixteen tons.

Fortunately the potato is a crop which can be grown successfully on any arable soil and is one which cannot be easily destroyed by invading forces The yields on the poorer land, when the crop is properly treated, compare favourably with those on better class land In fact the world's record yield of 35 tons per statute acre has been obtained in recent years on poor land at the foot of Muckish mountain in County Donegal. This extraordinary yield was obtained by attention to details many of which are neglected on the average farm. Indeed few farmers outside the special potato growing districts fully realise the importance of the combined effects of good tillage, selection of healthy stocks of suitable seed, well balanced manuring, sprouting, thorough spraying and general treatment of the crop. Take *first* the *selection* of the seed. All agree that a change of seed is necessary from time to time but it is feared that some farmers change the seed only for the sake of change. I say this because in many cases when they exchange or buy seed they are often bringing in material much worse than they had already got. A change, no matter where it comes from, may be utterly useless, unless the seed is the produce of healthy stocks and is, therefore, free from those crop reducing virus diseases which can only be observed in the field during the growing period. Increased yields due to the use of certified seed or seed which is the produce of healthy stocks may be estimated at not less than two tons per acre in the case of most varieties. To-day, thanks to the work of the late Dr. Davidson, together with the co-operation of the County Committees of Agriculture, the seed potato growers, and the potato merchants, we have in this country the best seed potatoes in the world. There are ample supplies of sound suitable seed available this season but it will not be possible to secure full supplies of certified seed of all the popular varieties. Here let me remind

those who wish to buy certified seed to make sure that the official red seal and grower's certificate number are on every sack. Remember that certified seed packed under the supervision of an officer of the Department of Agriculture can only be purchased in sacks bearing the official red seal. If the red seal is absent from the sack the seed potatoes may be unreliable and there is no guarantee of purity, or freedom from disease notwithstanding what may be branded on the sack itself.

In answering the question, what are the most suitable varieties to plant, one has to consider two factors:

(1) The export market

(2) The home market and general home requirements.

Our export trade is confined mainly to the sale of certified seed potatoes and is a specialised job in the hands of some of our best farmers who exported over 30,000 tons certified seed potatoes during the season 1939/40.

Exports of the 1940 crop will be smaller than usual because of increased demand for home requirements.

For home consumption the most popular early varieties are Duke of York, Sharpes Express, May Queen, Epicure, British Queen and Dunbar Rover. As to main crop varieties it is hard to beat Kerr's Pink and Arran Banner although we have on our list such new varieties as Arran Peak, Gladstone and Dunbar Standard.

The varieties most in demand for export are **Earlies :-** Arran Pilot, Ninetyfold, Eclipse, Sharpes Express, Duke of York, Epicure, May Queen, Catriona. **Second Early :-** Great Scot. **Maincrop :-**Majestic, Arran Banner, Gladstone, King Edward VII and to a limited extent Up-to-Date.

Dunbar Rover is the only newcomer among the earlies. It is of good table quality, maturing about the same time as British Queen, over which it has the advantage of being immune to Black Scab disease. There is only a small quantity of this variety for sale this season. Keep it in mind for next season.

Kerr's Pink may be regarded as a first class high yielding table variety although there are a few districts in the midlands where preference is still shown for such varieties as Skerry Champion, Sprys Abundance, Up-to-Date and to a limited extent, Golden Wonder.

Arran Banner is a heavy cropper. Yields of 15-20 tons are not uncommon and it is a popular variety for either home or export trade. Its table quality according to our standards is not so good but we must not on that account imagine that its feeding value is low. This is in fact the outstanding variety

to plant in these times to produce the largest bulk of food. Moreover this variety will give a bulky return as early as July—in other words at a very lean period.

Sprouting :

The value of well sprouted seed in the case of earlies and indeed of all varieties cannot be over-estimated especially if we are faced with a wet late spring. Lack of suitable accommodation, however, prevents farmers from adopting this practice more extensively. When sprouted seed is used there are no blanks in the field, and planting can be delayed during periods of bad weather or for other causes without reducing the final yield of the crop. The planting of whole medium size seed is recommended in preference to cut sets although some varieties such as Kerr's Pink and Arran Banner respond well to cutting. There is, however, always a risk of a large proportion of blanks occurring when cut seed is used especially if harsh weather conditions set in immediately after planting. Contrary to general practice the " Sciollâns " or sets may be planted immediately after cutting rather than wait for a few days to allow the cut surfaces dry out.

With regard to manures it is regretted that the standard dressings usually recommended will not be available in sufficient quantity this year and the supply of compound manures is also limited. Phosphatic manures are scarce and Potash is almost unobtainable. Nitrogenous manures such as Sulphate of Ammonia are also scarce. This, however, should not deter us as many have had the experience of growing excellent crops of potatoes on farmyard manure alone. Every effort should, therefore, be made to provide as much farmyard manure as possible and supplement this with such artificials as can be procured. Seaweed, too, is of great local importance in districts bordering the sea coast. It is rich in potash and gives excellent results on potatoes. If the position in regard to artificial manures should improve later on and the quantity of artificials applied at time of planting is considered insufficient, a further top dressing could be applied when the crop is being moulded or earthed up. The best results are, however, obtained when all the artificials are applied at the time of planting the crop.

In the preparation of the soil for drilling and notwithstanding the variety of modern implements available there is nothing to equal an extra cross ploughing to provide that depth of loose clay which is so desirable especially on stiff soils. An important stage in the after cultivation is the careful hand hoeing and thorough grubbing which the crop should receive previous to the first moulding or earthing. Neglect of the latter operation at this stage, can result only in a poor weed infested crop.

Drills should not be more than 27 in. wide. In fact in the early potato growing districts around our sea board, the most successful growers do not make drills more than 25 in. wide. Except in the case of early potatoes grown on sandy soils, it is important to have the drills well moulded so as to provide adequate protection for the tubers and prevent blight spores being washed on to them.

In dealing with the general cultivation of potatoes, one has to bear in mind that while the great bulk of the crop is grown in drills, a considerable area is and must be grown in ridges for reasons of soil conditions and lack of adequate drainage. Each district has its own special type of ridge or lazy bed all of which give satisfactory yields even though they involve much manual labour. Indeed the ridge system can be confidently recommended in cases where there is a last minute decision to put old lea under a potato crop this season. This recommendation applies especially where adequate equipment such as the disc cultivator is not available to reduce the old sod in a short time to a condition suitable for drilling.

There is little to be said on the question of spraying except that 8 lbs. bluestone and 10 lbs. of washing soda in 40 gallons of water is still the most effective means of preventing blight. Some of the proprietory preparations which have been recently placed on the market afford a good measure of protection, and are convenient to use.

Farmers should not neglect spraying the crop because of prospects of fine weather as this often results in great disappointment. It is just as important to have the crop well sprayed towards the end of the growing season as during the early stages of growth. The appearance of late blight can play havoc on a crop which had not been sprayed a short time previously. Such a crop goes down quickly and it may well be that a farmer, in his anxiety to get in say Winter wheat, digs his crop earlier than usual, only to find that later on in the season when he examines the potatoes in the pits, a large proportion are black and perhaps rotten. These potatoes were apparently sound when being put into the pit but carried the spores of blight which developed later during the first 3 or 4 weeks of storage. Each year there are complaints of this nature and it is hoped that during the coming season growers, by spraying thoroughly and spraying often, will guard against such losses.

Much has been said about increased production but the prevention of waste is of equal importance. Considerable waste in potatoes takes place each year during the months of March, April and May. The potatoes required for domestic use should be selected now and the remainder made into potato silage. Full directions for the making of this silage are given in the Department's Special Leaflet No. 9. Farmers who are not convinced of the feeding value of potato silage are recommended by way of experiment to cook 2 or 3 cwt. of potatoes, drain off the water, pack them while still hot in an ordinary 40 gallon barrel but provide for drainage and cover to exclude air. The resulting product if used one month hence or 12 months hence will have the feeding value of freshly cooked potatoes, and pigs will readily consume it. This simple trial will be so convincing that all surplus potatoes retained for feeding of pigs and poultry will be converted into potato silage early next season.

And now a final word. The scarcity of feeding stuffs for man and beast

becomes graver every hour. The potato planting season is with us. While it remains there will be an opportunity for putting in a crop which, acre for acre, will produce double the quantity of food produced by any other; which will go far to render the farmer independent of concentrated feeding stuffs; and which in the dangerous times ahead may be the Nation's greatest bulwark against hunger. No time should be lost in making the necessary preparations for planting an increased area. Above all no time should be lost in securing the necessary seed if this is not already available.

Potato growers and indeed farmers generally are advised to be careful in regard to the purchase of new brands of imported organic fertilizers. It is likely that products would be offered at the present time as fertilizers which would have nothing to commend their application to the potato crop.

THE CONTROL OF SOME FUNGUS DISEASES OF FARM AND GARDEN CROPS

(10) Broadcast Talk entitled "THE CONTROL OF SOME FUNGUS DISEASES OF FARM AND GARDEN CROPS" given by ROBERT MCKAY, D.Sc., Lecturer in Plant Pathology, University College, Dublin on 10th March, 1941.

In crops grown by the farmer, or gardener, prevention of disease rather than cure should be aimed at, and most of the treatments recommended for the control of fungus diseases have this object in view. Only in a comparatively small number of cases can diseased plants be cured once they are attacked.

Owing to the importance of cereals at the present time as the chief source of food, I shall begin with some diseases of wheat, barley and oats. Perhaps the most important diseases of cereals are those known as covered smuts. In plants infected with these diseases the normally healthy grains are replaced by a black sooty powder, which consists of the spores of the fungus. These spores are distributed during threshing operations and contaminate the healthy grains. When such grain is sown, the adhering spores germinate at the same time as the seed, and infection of the young seedlings occurs. The fungus grows up inside the developing plant but its presence is not detected until the plant is coming into ear. Other seed borne diseases are those known as Leaf Stripe of Oats and of Barley. In these, however, the fungus either kills the seedling before it emerges from the soil, or the disease is visible on the leaves from the time the braird appears. Two, three, four or more leaves at the base of the plant are attacked and often killed outright. The result is a thin stand of plants and a crop in which many of those surviving are so weakened that the normal amount of grain is not produced.

These seed borne diseases, covered smuts of wheat, oats and barley, and Leaf Stripe are easily prevented or reduced to negligible proportions by suitable treatment of the grain before sowing, with one or other of the recognised mercurial dusts which are now on the market for this purpose. Full instructions are issued with the preparations and the cost of treatment is trifling.

Another serious disease of cereal crops is that known as Black Stem Rust. The fungus responsible for this disease is peculiar, in, that it requires two entirely different host plants to complete its life cycle, one part of its life being spent on a cereal crop and the other on the common Barberry Bush. In this country it is not surprising, therefore, that the earliest and worst attacks of Black Stem Rust occur on wheat adn on oats in those districts where the Barberry is growing

wild. Early attacks of the disease result in stunted plants and poorly developed grain. Once the disease appears on the cereal crop nothing can be done to prevent it spreading. Complete destruction of the common Barberry is the only obvious method of control. Farmers are advised, both for their own sake and for the common good, to uproot and destroy all Barberry bushes wherever they find them growing on their farms. The elimination of the Barberry may not entirely prevent attacks of Black Stem Rust but its absence does postpone attacks until late in the season, in which case the grain is usually well developed. Different strains of Black Stem Rust attack oats and wheat, and the disease does not pass from the oat crop to the wheat or from wheat to oats.

As a matter of general interest in connection with Black Stem Rust, it is well to remember that practical farmers observed the association of the disease on wheat with the presence of Barberry bushes long before the scientist proved any connection to exist between the two, and laws for compulsory eradication of Barberries were in force in France as early as 1660 and in North America in 1726.

Next to grain the most important food crop is the potato. Irish farmers are only too familiar with ordinary Potato Blight but how many of them realise, that the great majority of initial outbreaks of this disease each year, occur on sites of old potato pits and on plants arising from discarded tubers which are left lying about the hedgerows and other places. So far as known at present diseased potato plants arise at first **only** from blighted tubers and the disease then spreads to neighbouring healthy plants. Hence, every care should be taken to see that no blighted tubers are planted or are left lying about anywhere to propagate disease.

With regard to the mixing of potato sprays, when home made Bordeaux or Burgundy mixture is used, the instructions given in the Department of Agriculture's Leaflet No. 14, should be closely followed. Dilution before mixing of the two substances employed is essential for a good spray. The practice, which exists in some districts of throwing the two ingredients into the barrel to dissolve at the same time cannot be too strongly condemned, as it results in a much less efficient spray.

Turning to garden crops : in the case of onions the most serious disease during the growing season is Downy Mildew. Here, as in the case of the Potato Blight, the disease usually appears first on plants in which the fungus has over-wintered. These plants may be shallots, or potato onions, planted in spring, or ordinary onions which were sown the previous autumn. Autumn sown onions frequently contain infected plants but no symptoms of disease appear until about the middle of March or later. As soon as weather conditions become sufficiently mild, the fungus, which was internal in the plants, grows out and fructifies, and the disease spreads rapidly to others in the same plot and finally to spring sown onions. One or two diseased plants occurring in the month of April or May are sufficient to start an outbreak of mildew and in this case it is *imperative* that the diseased

plants should be removed at once, because no spray has yet been found to be effective against the spread of Onion Mildew. Careful watch should be kept throughout April and May on all plots of autumn sown onions as well as on plants raised from small bulbs, shallots or potato onions, and any mildewed plants re moved as soon as detected. Infected plants may often be recognised in the spring of the year before the mildew appears on their foliage by their habit of having the older outer leaves turgid and bent outwards and downwards in the form of an arc. This symptom may or may not be accompanied by a glazed yellowish appearance of the foliage.

Amongst fruit crops the apple may be considered the principal one and the worst disease of apples is undoubtedly apple scab. Early infection of the leaves, flowers and fruit may arise either from ascospores which have been produced on dead leaves or from sources on the tree itself such as scabbed one-year-old wood or infected bud-scales in which the fungus has overwintered. Infected bud-scales constitute one of the most important sources of early scab infection in this country. Wherever the disease is prevalent during the growing season infected bud-scales invariably occur during the next dormant season, and the diseased bud-scales may produce spores as early as the month of February. The greatest quantity of spores, is however, produced during March and April when the trees are coming into leaf and flower. Spores produced in this manner are ready to attack the young leaves as soon as ever they appear. From the foliage the disease then spreads to the flowers and fruit.

Good control of apple scab is only obtained by early and systematic spraying, either with Lime Sulphur or with Bordeaux mixture, the former being recommended for the drier districts of the country and the Bordeaux mixture for those districts with a high rainfall. Three, four or more applications of the fungicide may be required depending on the season but in all cases it is advisable to spray at least once pre-blossom, at the pink-bud stage, again at petal-fall, following this with a third application about three weeks later. When the disease is controlled early in the season and its establishment on the tree prevented, then the effects are lasting throughout the year. If, however, scab becomes established on the tree early in the season, later spraying has little or no effect on the development of the disease that year.

Finally, full descriptions of all these diseases and more detailed measures of control are given in the leaflets issued by the Department of Agriculture, and persons desiring more information may have the required leaflets sent to them, free of charge, on application to the Department of Agriculture, Upper Merrion Street, Dublin.

SILAGE AS A SUBSTITUTE FOR IMPORTED FEEDING STUFFS.

(11) Broadcast Talk, entitled "SILAGE AS A SUBSTITUTE FOR IMPORTED FEEDING STUFFS" given by Mr. T. O'CONNELL, Chief Inspector, Department of Agriculture, on 24th March, 1941.

The previous talks in this series dealt mainly with the production of foods suitable for human consumption. To-night's departure from this particular aspect of production does not imply that all is well and that we are satisfied with what has been achieved to date. Very far from it indeed. Farmers have battled bravely against the unfavourable weather of the past two months and we know of many cases where, after the seed had been held ready for weeks, the sowing of winter wheat was finally abandoned. The Spring wheat varieties April Red, Diamant and Kolben may be sown for four weeks yet, but the additional area cannot compensate for the Winter varieties. It is, therefore, imperative to make up in the shape of potatoes, oats, and barley for the deficiency in the wheat area that "would have been," a deficiency which may indeed be estimated at anything from 100,000 acres downwards.

It may unfortunately happen, however, that two or three months hence, when the cropping season is over, we shall find ourselves short of the tilled area necessary to provide substitutes for the half a million tons or so of imported cattle feeding stuffs which we can no longer procure. It is then, and particularly as seeds for catch crops may be unprocurable, that the making of silage for the feeding of live stock will provide a valuable contribution to food production.

Non-farming listeners may well ask what is silage. It is the product which results when fresh green material is subjected to treatment designed to preserve its succulence for an indefinite period. The small onions which a housewife preserves for future use in a solution of vinegar may as truly be called onion silage as pickled onions. Fresh gooseberries cooked to pulp and preserved with the aid of sugar, may as properly be termed gooseberry silage as gooseberry jam. The principle is the same in each case, namely, the establishment of conditions which cause the destruction of the organisms which promote decay, and which retard the subsequent development of similar bodies.

What is the green succulent material which the farmer is asked to preserve as silage? So far as this country is concerned there is only one answer. It is the grass which grows so abundantly in our moist—alas at times far too moist—climate, the material whose extraordinary greenness in the early stages of growth is but the outward evidence of the presence of certain vital food factors in a most digestible form.

Whether he is dairy farming in the Golden Vein or cattle grazing in Meath or Roscommon the farmer is well aware of the value of grass in the production

of milk or of beef. He knows by experience that its nutritive qualities are highest when it is comparatively young, that it is less productive as the season advances, and that a stage arrives when, despite its quantity, it provides merely a maintenance ration. He knows, too, that an animal which has suffered from constitutional derangements during winter and which physic and condiments have failed to restore to health, will often acquire a new lease of life when placed on summer grass.

The farm crops usually cultivated here provide in the main the starchy ingredient of animal feeding stuffs. Grass is a complete food in itself, providing not only the protein which we normally import in the form of concentrated cakes and meals, but in fact a protein of higher biological value. In addition it contains certain vitamins and associated bodies which are particularly valuable in the diet of milch cows. It is generally admitted that silage made from grass or other green material cut at a comparatively immature stage and properly preserved through the medium of certain fermentative processes retains most of the qualities of the original grass. This is now recognised in many countries. The raw material for the making of silage available in our own country cannot be excelled. In no other country does grass grow more luxuriantly during the early portion of the season—much of it to be wasted at a later date. Nowhere else because of the very nature of our climate, does upland hay suffer a greater loss of food ingredients. Well saved rotation hay plus grain and roots will require little by way of supplement in the production of milk or meat, but second quality hay in the absence of other foods is simply a starvation diet. Yet in some of the principal dairying districts in the country, second quality meadow hay constitutes practically the sole diet of in-calf cows during the winter months. A yield of eight to ten tons of silage per statute acre is easily feasible in these areas. Nine tons of good silage is equivalent in feeding value to $1\frac{1}{2}$ tons of mixed meals and twenty pounds of the same quality silage will produce a gallon of milk.

Nine tons of silage will provide about $2\frac{1}{2}$ stones per cow daily for four in-calf cows from the middle of November to the middle of April. If the cow is dry, this with a few pounds of reasonably good hay and a few roots, if available, will bring her through the winter in excellent condition. If she is still in milk during winter an additional 18 lb. to 20 lb. of silage will suffice for each gallon she produces.

Contrast this dry cow in early spring with a similar animal which has received during winter merely a couple of stone of badly saved meadow hay. The one is sleek, well nourished and fit to undertake her natural function to produce a healthy calf and subsequently to give a good milk yield. The other is just able to amble to the spring pasture. If she produces a calf it is often a weakling, and because nature demands the utilisation of her summer food to rebuild her wasted frame, her potential milk yield in the ensuing lactation period is seriously diminished.

This is the treatment which is intimately related to our abnormally low average milk yield of 400 gallons or so per cow per annum. The cow is not at fault for it would scarcely be possible to purchase a cross bred shorthorn heifer in a fair in the dairying districts of Munster which, on a suitable ration, would not produce 600 to 700 gallons in her third or fourth lactation period. Many such heifers have indeed reached 800 gallons and upwards.

Milk is the most indispensable ingredient of our people's diet. Because of this and for reasons of National economy it is imperative that our dairying industry should be maintained, and at regular intervals certain measures are advocated in this direction. They include a higher subsidised price for creamery milk, more suitable stock bulls, extension of cow testing, etc. Rarely if ever do those concerned advocate the really fundamental remedy, namely, better treatment of the cow. If they do, it is only to associate it with an assertion that it will not pay to feed for high milk yields at creamery prices This is true if the food is to consist of maize and cotton cake from the ends of the earth. It is not true if it is provided in the form of nutritious grass silage, which can be produced economically in quantities up to 10 tons per statute acre, or, as already indicated, in quantities equivalent to 1½ tons of concentrates. Can it be that our mild winter climate which enables a dairy cow to subsist on upland hay and the residue of summer pasture is an ultimate disadvantage to the dairying industry ?

It must not be assumed that silage is important merely for milch cows. It is equally suitable for store and fattening cattle, in fact pigs will greedily consume a certain quantity of silage. Recently announced restrictions on the export of certain classes of our store cattle will mean in future a larger reservoir of younger animals. Grain and roots as supplements to grass will be necessary in greater quantity than formerly for their upkeep. Failing a sufficiency of these, silage is the obvious substitute. Even with a large extension of tillage in the grazing districts, there will still be ample room for silage, and where else in the world are conditions more suitable for its production than on these rich pastures ?

Year in year out the Department has advocated the adoption of silage. Schemes of grants and loans, for the erection of silos, have been in operation, scores of demonstration silos have been erected free of charge, leaflets and verbal instruction have been available, but the response has been disappointing.

In anticipation of conditions arising out of the emergency which was foreshadowed in 1939 a fresh campaign was instituted in the summer of that year. It appears that at last the light is beginning to spread, and last season an extra 350 silos were erected in the country. Appropriately the great majority were erected in the dairying districts of Munster and the grazing district of North Leinster.

We have rarely known a farmer who adopted silage making and who followed the simple rules recommended for its manufacture who did not speak with enthusiasm of its advantages. These farmers now realise that silage is a suitable substitute for the imported feeding stuffs which are no longer obtainable. They realise also that in the critical days ahead, home-grown cereals other than wheat, may be required for human consumption and perhaps command prices beyond the reach of the stock-breeder. If only the general body of farmers, particularly in the more fertile counties, will realise these facts the number of silos to be erected this season should be nearer 3,000 than 300.

The farmer who contemplates making silage this season must just now make certain provisions. This is in fact the principal reason for this talk at a date long before grass is available.

Good silage has been made in clamps or pits, but it will pay to provide a proper silo and this is a matter for immediate attention. The Department's Leaflet on Ensilage No. 105 gives full particulars regarding a circular silo which can be erected at a moderate cost with concrete blocks. These can be made by farm workmen at times when the weather is unfavourable for outdoor operations. It has been shown that a silo of this type capable of holding thirty-five tons of sillage or say the produce of four acres can be erected for about £20, including the cost of a corrugated iron roof. A loan for this amount can be obtained from the Department on easy terms, or up to £40 for two such silos In addition most Committees of Agriculture give free grants of about £5 for the erection of silos of this type. Portable concrete slab silos which have certain advantages can be procured from a number of commercial firms. A loan of £10 may be obtained for the erection of one of these silos or up to a maximum of £40 for four such silos.

It is scarcely necessary to say that grass intended for silage this season should not be grazed from now onwards. Normally a dressing of artificials, or at least a cwt. of Sulphate of Ammonia per statute acre would be most desirable, but in present circumstances this may not be possible. It is fortunate that in the districts where silage is most desirable and most practicable, heavy crops of grass can be procured even without topdressing. Nothing can excel liquid manure for the purpose, and if by hook or by crook this could be conserved both for grass and for other crops, much less would be heard of the present shortage of nitrogenous manures.

The Department is frequently asked for advice as to whether it is best to make ordinary untreated silage, molassed silage or acid silage. Their experience is that no method is foolproof, but that with the exercise of reasonable intelligence in the making, any of these types can be excellent. This being so and as the simplest form is most likely to appeal to farmers the Department generally advise that no treatment is necessary.

In order, however, to give practical farmers an opportunity of judging for themselves the merits of the different types, a large scale demonstration was planned two years ago in North Cork, South Tipperary and Limerick. At the end of the present season, and provided the necessary supply of acid can be procured, each of the thirty farmers who are participating in the Scheme and for whom silos were erected free of charge will have had experience of each type on his own farm. In the meantime the results have been most gratifying. The farmers concerned, some of whom were sceptical at the outset, have been highly pleased with the results, irrespective of the type of silage made by them, and after the first year's experience, many either enlarged their silos or erected a further silo. On one of these farms, cows fed on silage and running on grass yielded five gallons daily at one stage.

Acid of the type usually recommended for silage may not be procurable commercially at present. Molasses produced at the sugar beet factories is used mainly for admixture with sugar beet pulp, but a considerable supply is available at the factories for farmers who require it and who place orders accordingly.

As already stated, excellent silage can be made without any treatment whatever. All that is necessary is to cut the grass at the proper stage, to follow carefully the simple instructions for packing the silo, and to ensure that a roof or other suitable protection is provided to prevent the access of rain water. A farmer may use molasses if he so desires, but if he cannot conveniently procure it he should not hesitate, as opportunity offers, to make the necessary arrangements for making plain silage. The Department's leaflet already mentioned contains detailed particulars. The Agricultural Instructors throughout the country will be glad to visit and advise.

The rest lies with the farmer. His aim must be more tillage crops while there is yet time, and afterwards to produce, in the form of silage, the equivalent of one and a half tons of concentrates per statute acre.

(Issued as Special Leaflet No. 18).

POTATO GROWING IN IRELAND WITH PARTICULAR REFERENCE TO PRODUCTION FOR INDUSTRIAL PURPOSES

by

PROFESSOR J. P. DREW, M.Sc., A.R.C.Sc.I., and D. DEASY, B.Agr.Sc.,
University College, Dublin.

In a previous paper (1) attention was directed to the production of potatoes generally and to the selection of varieties suitable for the production of industrial alcohol. Results of variety trials were shown and a comparison made between some of the leading varieties grown on the Continent for industrial purposes and some of the most prolific varieties more commonly grown in this country, the comparison being made between yields of tubers, percentage of starch and total yield of starch per statute acre.

Incidentally, reference was made to various factors which not only influenced the productivity of the potato but also had varying effects on the percentage of starch in the produce. In this connection particular attention was drawn to the effects of soil, climatic conditions and the incidence of diseases, particularly virus diseases on the yield and percentage of starch of potato varieties generally.

During the progress of the investigation, however, it was seen that there were other factors influencing both the productivity and percentage of starch of the potato and the object of this report is to direct attention to some of these factors.

Size of Tuber and Percentage of Starch.

In the determination of the percentage of starch by the specific gravity method it was seen that the percentage of starch varied from sample to sample within each variety under examination although the greatest care had been taken to have each sample representative of the bulk produce from which it had been taken. While some of this variation in the percentage of starch may be attributed to differences in soil conditions from plot to plot, it would appear that the relative proportion of different sized tubers in the samples which were taken on a weighted basis, influenced the percentage of starch for each sample, since the produce of any two plots under the same variety did not possess the same proportion of the different size tubers; samples with a high proportion of large tubers differing as regards the percentage of starch from those in which medium to small tubers formed the greater bulk.

In view of the fact that it is possible by cultural and other treatments to influence the size of tubers in the produce and that the higher the percentage of starch, consistent with yield, the more valuable is the produce both for the grower and manufacturer, it was decided to enquire into the relationship between size of tuber and percentage of starch.

For the purpose of this experiment a large bulk sample of the continental variety, Parnassia, was taken and divided into four grades—very large, large, medium and small, the grading being carefully done by hand to ensure that the tubers in each grade were of a uniform size. Each grade was then divided into fifty random samples of ten tubers each, and the percentage starch in each determined by the specific gravity method outlined in the previous report (1). The results obtained are set out in Table I.

TABLE I.

SIZE OF TUBER v. PERCENTAGE OF STARCH

No. of Sample	VARIETY PARNASSIA			
	Very Large Tubers Av. 197 grms.	Large Tubers Av. 112 grms.	Medium Tubers Av. 60 grms.	Small Tubers Av. 33 grms.
	% Starch	% Starch	% Starch	% Starch
1	14.25	15.75	16.50	17.40
2	15.25	15.50	15.00	15.50
3	15.25	15.00	15.25	15.25
4	16.25	16.00	15.75	17.00
5	16.00	15.00	15.75	16.00
6	15.05	16.30	15.50	14.50
7	15.50	16.00	16.75	16.40
8	15.75	15.50	16.00	15.50
9	14.25	16.00	17.00	14.25
10	14.65	15.00	14.60	17.40
11	15.50	15.75	14.75	17.00
12	15.25	15.00	14.50	14.50
13	14.50	15.50	16.50	14.50
14	15.00	16.30	15.25	16 50
15	15.75	15.75	16.30	14.60
16	15.50	14.60	16.30	16.30
17	15.50	16.00	15.00	17.00
18	15.25	15.00	15.25	15.00
19	14.50	14.75	16.40	14.50
20	14.50	15.50	15.25	16.00
21	15.75	15.00	15.00	15.75
22	16.40	15.25	15.75	15.25
23	15.00	15.50	15.25	15.00
24	15.25	15.75	15.75	17.50
25	15.25	14.60	18.00	16.40
26	15.00	16.30	16.00	14.60
27	15.25	15.25	15.75	14.75
28	14.80	15.75	15.25	15.00
29	16.40	16.00	14.75	15.75
30	15.25	15.75	14.00	15.75
31	15.50	15.50	17.40	15.50
32	15.75	15.00	15.00	16.00
33	14.60	15.25	16.30	15.75
34	15.00	15.75	15.50	16.00
35	15.00	14.50	16.50	16.30
36	15.25	16.40	14.00	16.40
37	16.40	15.25	15.75	16.00
38	15.25	15.75	15.75	17.00
39	15.50	15.50	16.00	14.60
40	15.25	16.30	14.75	16.30
41	15.50	15.75	15.50	16.50
42	15.25	14.60	15.00	14.00
43	15.50	14.75	17.20	16.30
44	14.50	15.50	15.50	15.75
45	14.75	15.50	14.75	15.75
46	15.00	15.75	15.75	16.00
47	15.00	15.25	15.50	15.75
48	15.25	16.30	17.00	15.75
49	14.75	16.00	16.00	16.40
50	14.75	15.25	16.75	16.30
Mean	15.23	15.51	15.70	15.78

The average weight of tuber for each grade was I. 197 grms. (7 ozs), II. 112 grms. (4 ozs.), III. 60 grms. (2 ozs.), IV. 33 grms. (1 oz.), indicating the marked difference in size of tuber between each grade. It will be seen from the figures for each grade that the percentage of starch varied from sample to sample, and that some of the figures obtained were common to all grades. The mean results, however, show that the very large tubers and the small tubers gave the lowest and highest mean percentage of starch respectively, a reduction in size of tuber being accompanied by an increase in the percentage of starch.

In view of these results it was decided to enquire into the effect of plant spacing on the size of tubers and total yield of crop and to obtain further data in the relationship between size of tuber and percentage of starch.

Since the results outlined on Table I were obtained with a variety with a medium percentage of starch it was arranged for the purpose of this trial to use the variety Arran Banner, this being one of the most prolific varieties commonly grown in this country. It has, however, a very low starch content, on which account it is not very suitable for industrial alcohol production If the results obtained with the variety Parnassia (Table I) would apply to this variety and it were possible by cultural treatment to increase the proportion of medium and small tubers without affecting the yield, the value of Arran Banner for industrial purposes would be increased.

EFFECT OF SPACING ON YIELD AND SIZE OF TUBERS.

The trial plots were arranged to include 24, 26 and 28 inch drills with the potatoes planted at 9, 12 and 15 inches respectively in each of the different width drill. The plots were 1½ square perches in area made up of four drills and arranged in random blocks having four replications. These plots were cultivated and manured and the crop treated in exactly similar manner to that of the main potato crop which was contiguous to the experimental area

The two outside drills of each plot were discarded at lifting time and the produce of the individual plots was treated separately and the yield per acre calculated. The produce from each plot was then divided into three grades, large, medium and small, using a potato sorter, and the weight of each grade recorded. In this way the relative proportion of different size tubers in the total crop for each spacing was obtained. The results obtained are set out on Table II

TABLE II.

EFFECT OF SPACING ON YIELD AND SIZE OF TUBERS.

Mean Total Yield per Stat. Acre.

Spacing of Plants	WIDTH OF DRILL		
	24 in.	26 in.	28 in.
	Tons per acre	Tons per acre	Tons per acre
9 in.	17.2	17.60	15.60
12 in.	17.[illegible]	16.10	16.80
15 in.	14.9	16.00	16.00

Large Tubers as a percentage of Total Crop.

Spacing of Plants	WIDTH OF DRILL		
	24 in.	26 in.	28 in.
9 in.	49.22%	53.41%	59.74%
12 in.	61.78%	57.41%	61.17%
15 in.	63.40%	64.28%	69.91%

Medium Size Tubers as a percentage of Total Crop.

Spacing of Plants	WIDTH OF DRILL		
	24 in.	26 in.	28 in.
9 in.	41.01%	36.83%	34.13%
12 in.	31.15%	36.38%	33.13%
15 in.	30.07%	29.19%	24.76%

Small Tubers as a percentage of Total Crop.

Spacing of Plants	WIDTH OF DRILL		
	24 in.	26 in.	28 in.
9 in.	9.77%	9.78%	6.13%
12 in.	7.07%	6.21%	5.70%
15 in.	6.53%	6.53%	5.33%

Yield of Tubers. The heaviest mean yield of tubers was obtained with the 9 inch spacing in the 26 inch drill : this was, however, only slightly higher than the yields obtained from the 9 and 12 inch spacings in the 24 inch drills. It was observed, however, that a 24 inch drill was too narrow for a prolific variety like Arran Banner as many of the tubers had become " greened " from exposure to light. The lowest mean yields were obtained from the 9 inch spacing in the 28 inch drill and from the 15 inch spacing in the 24 inch drills.

Large tubers as a percentage of total yield. As would be expected the highest percentage of large tubers was obtained from the maximum spacing, that is 15 inches in 28 inch drills, and the lowest percentage of large tubers from the minimum spacing, 9 inches in 24 inch drills. Generally, there was an increase in the percentage of large tubers with increased spacing of the plants.

Medium tubers as a percentage of total crop. The highest and lowest percentage of medium size tubers was obtained from the 9 inch spacing in the 24 inch drills and from the 15 inch spacing in the 28 inch drills respectively. In each of the different width drills the percentage of medium size tubers was reduced with increased spacing.

Small tubers as a percentage of total crop. As in the case of the medium size tubers, the highest and lowest percentage of small tubers was obtained from the 9 inch spacing in 24 inch drills and the 15 inch spacing in the 28 inch drills respectively. Again, increasing distance between the plants in each of the different width of drills was accompanied by a reduction in the percentage of small tubers.

The produce from the various plots under the spacing trials was all bulked together and from it four grades of tubers, very large, large, medium and small, were selected, care being taken to have as far as possible the tubers comprising each grade of uniform size. From each grade fifty samples of ten tubers each were selected at random and submitted to starch determination by the specific gravity method with the results as shown on Table III.

TABLE III.

SIZE OF TUBER v. PERCENTAGE OF STARCH.

No of Sample	VARIETY ARRAN BANNER			
	Very Large Tubers Av. 269 grms.	Large Tubers Av. 157 grms.	Medium Tubers Av. 114 grms.	Small Tubers Av. 78 grms.
	% Starch	% Starch	% Starch	% Starch
1	15.00	13.75	14.00	12.50
2	15.75	13.00	13.30	13.50
3	13.75	13.75	14.75	14.25
4	14.00	12.75	14.60	13.15
5	14.60	15.75	14.00	13.75
6	14.50	14.75	13.75	13.50
7	14.60	13.15	14.25	13.75
8	13.30	14.25	13.15	13.50
9	14.25	14.60	15.25	13.00
10	13.50	14.60	13.15	12.00
11	14.25	12.50	13.00	13.15
12	13.75	14.50	15.50	12.75
13	13.30	14.25	13.75	14.50
14	14.25	14.25	13.15	14.25
15	13.50	13.50	14.75	13.50
16	14.25	14.00	14.00	14.00
17	14.25	13.30	13.75	16.30
18	14.60	14.00	14.75	14.00
19	14.25	14.60	13.50	14.50
20	14.50	13.15	13.15	12.50
21	15.00	15.00	14.50	14.50
22	14.00	13.50	13.15	13.00
23	13.15	15.25	13.50	14.60
24	13.75	14.75	12.50	13.30
25	14.25	14.60	14.25	13.50
26	14.50	15.50	14.60	13.00
27	14.25	14.50	15.00	12.75
28	14.60	13.15	14.25	13.30
29	14.25	14.50	13.30	14.75
30	13.75	13.30	14.25	13.30
31	14.50	14.50	14.50	14.50
32	14.50	14.25	14.60	13.00
33	14.50	14.50	13.00	13.15
34	14.00	13.15	12.50	14.75
35	14.50	13.75	13.30	12.75
36	14.00	14.75	13.00	14.25
37	14.50	14.00	11.70	15.50
38	14.75	14.50	14.00	13.50
39	13.75	14.75	13.30	14.50
40	13.00	14.00	14.60	14.00
41	14.75	13.75	15.50	13.00
42	13.15	15.75	14.75	13.50
43	14.25	12.50	14.50	14.50
44	13.50	14.25	12.75	12.75
45	14.25	13.30	15.00	13.30
46	13.50	13.50	13.15	12.25
47	14.60	14.75	12.75	13.30
48	13.50	14.75	14.75	13.75
49	14.50	14.50	15.00	14.50
50	14.25	14.00	14.75	13.50
Mean	14.16	14.13	13.92	13.65

The average weight of tubers in each grade was I. 269 grms. (9½ ozs.), II. 157 grms. (6 ozs.), III. 114 grms. (4 ozs.) and IV. 78 grms. (2¾ ozs.). The figures for the percentage of starch show a great variation within each grade, some of the results obtained being common to each grade. The mean results show that the highest percentage of starch was obtained from the very large tubers and that decreasing size of tubers was accompanied by a reduction in the percentage of starch.

In view of the fact that these results differed from those obtained with the variety Parnassia it was considered desirable to make further trials in this connection. These were accordingly carried out using two different varieties, viz. Parnassia, of medium starch content, and Hellena, of high starch content. As in the previous cases, fifty samples each containing ten tubers were examined for each variety and the results are shown on Table IV.

TABLE IV.

SIZE OF TUBERS v. PERCENTAGE OF STARCH.

Sample No.	VARIETY PARNASSIA				VARIETY HELLENA			
	Very Large Tubers Av. 250 grms.	Large Tubers Av. 152 grms.	Medium Tubers Av. 86 grms.	Small Tubers Av. 41 grms.	Very Large Tubers Av. 286 grms	Large Tubers Av. 184 grms.	Medium Tubers Av. 88 grms.	Small Tubers Av. 52 grms.
	% Starch	% starch	% Starch	% Starch	% Starch	% starch	% starch	% starch
1	17.40	16.50	15.75	14.60	18.65	19.25	18.65	15.50
2	16.30	15.25	15.50	14.75	18.00	19.25	17.40	17.40
3	17.00	17.20	14.75	13.30	19.00	18.65	18.65	15.75
4	17.20	16.30	13.15	13.30	19.25	18.83	19.00	13.00
5	17.25	15.50	15.75	15.25	19.75	16.50	19.25	18.50
6	16.50	17.50	16.40	14.00	17.40	17.40	19.50	17.00
7	16.50	17.75	17.75	15.75	18.65	18.83	18.25	16.75
8	17.20	16.40	15.75	16.00	18.00	19.00	18.65	16.75
9	16.00	16.00	15.50	17.00	19.00	18.50	19.50	19.00
10	16.40	18.00	16.00	16.40	18.83	19.25	16.30	14.75
11	16.50	16.30	15.00	15.25	17.20	18.83	17.50	14.00
12	16.40	15.25	15.75	15.25	19.00	19.25	17.40	17.40
13	15.50	16.00	14.50	14.00	18.00	18.65	18.25	16.75
14	16.30	17.40	16.40	14.50	17.20	18.65	17.50	15.25
15	17.00	16.30	14.25	12.50	19.25	19.50	15.75	16.00
16	16.30	16.40	15.75	15.00	18.50	18.83	17.75	17.75
17	17.00	16.30	16.00	12.75	18.65	18.50	16.50	14.75
18	17.75	16.75	16.75	14.50	18.50	18.50	19.25	18.65
19	16.40	16.40	15.00	14.75	17.20	19.50	18.83	16.00
20	16.75	18.25	16.40	12.50	18.83	17.75	18.65	17.50
21	16.00	15.00	16.40	13.14	18.83	19.25	18.50	18.00
22	16.00	17.20	14.25	14.75	18.65	18.83	18.50	15.50
23	16.00	17.40	15.25	11.85	18.00	18.83	18.50	17.40
24	17.75	17.00	14.75	11.00	18.65	19.00	18.25	17.50
25	17.40	15.75	14.70	13.30	18.00	18.25	17.40	17.40
26	15.00	15.75	16.00	14.50	18.00	19.25	17.50	14.75
27	16.50	17.40	16.30	14.75	16.75	19.25	18.83	17.00
28	14 75	17.20	15.75	14.50	19.00	18.83	17.50	17.20
29	16.30	17.40	15.25	15.25	17.20	19.00	19.00	16.50
30	18.00	17.20	16.00	12.25	18.50	18.00	18.00	17.40
31	17.75	15.75	14.75	13.30	18.65	18.65	17.20	17.75
32	16.50	15.25	16.00	13.50	18.50	18.83	18.50	17.50
33	15.75	17.75	15.50	15.00	18.00	17.00	18.25	17.75
34	16.50	16.40	13.15	12.50	19.25	18.83	17.75	17.75
35	17.20	16.30	16.50	12.00	18.00	19.50	18.65	14.60
36	16.75	16.00	15.75	13.00	18.65	18.83	15.75	15.75
37	17.00	17.50	16.00	14.50	19.00	19.00	18.50	15.25
38	17.40	16.75	16.40	14.25	18.83	18.65	18.65	16.00
39	17.00	15.50	15.50	13.30	19.00	19.00	17.75	15.00
40	18.65	15.50	17.50	13.70	19.50	18.00	18.50	16.30
41	16.00	16.00	15.75	14.60	18.83	18.65	18.25	15.75
42	16.30	16.40	16.40	15.00	19.25	19.75	17.75	15.50
43	15.75	17.50	15.50	15.00	19.00	16.00	18.83	16.75
44	17.40	15.75	15.50	15.50	19.50	18.83	18.25	16.50
45	15.50	17.40	16.40	14.75	17.40	18.50	18.50	17.50
46	16.50	15.50	14.50	14.75	19.00	19.50	18.25	15.75
47	17.75	16.50	16.00	12.50	18.25	18.83	18.00	15.75
48	18.00	15.75	15.00	15.25	18.00	17.75	16.30	16.00
49	17.00	16.30	15.50	15.75	18.50	18.50	17.50	19.25
50	18.25	15.25	17.20	13.75	18.83	18.65	18.83	17.40
Mean	16.73	16.48	15.63	14.19	18.48	18.66	18.08	16.54

Variety Parnassia. The mean weight per tuber for the four grades was I. 250 grms. (9 ozs.), II. 152 grms. (5½ ozs.), III. 86 grms. (3 ozs.) and IV. 41 grms. (1½ ozs.). As in Tables I and III, variation in the percentage of starch for the different samples was obtained, a number of the results obtained being common to the four groups. The mean figures for each group show a decrease in the percentage of starch with each reduction in size of tuber, these results, therefore, agreeing with those obtained for the variety Arran Banner.

Helena. The mean weight per tuber for the different grades was I. 286 grms. (10 ozs.), II. 184 grms. (6½ ozs.), III. 88 grms. (3 ozs.) and IV. 52 grms. (1.85 ozs.). While the percentage of starch for the individual samples within each grade varied, this was not as marked as that obtained in the tests with other varieties.

The mean results show that the percentage of starch for Grade II tuber was very slightly higher than that of Grade I, otherwise the results are in agreement with those of Parnassia above and with Arran Banner, Table III. In the determination of the percentage of starch in this variety it became necessary to divide the tubers by cutting as this variety was very subject to hollow centre, which was very much more pronounced in the case of the larger tubers ; this may have been responsible for the slightly lower percentage of starch in the very large tubers than that of Grade II tubers.

THE INFLUENCE OF "HOLLOW CENTRES" IN POTATO TUBERS ON THE DETERMINATION OF THE PERCENTAGE OF STARCH BY THE SPECIFIC GRAVITY METHOD.

In the previous paper (1) attention was drawn to the susceptibility of certain varieties of potatoes to "hollow centres" and the effect this may have on the determination of the percentage of starch by the specific gravity method, unless the precaution of exposing the cavity by cutting open the tubers had been taken. This operation would, however, entail more labour and time where the percentage of starch in a large number of samples had to be determined. On this account it was considered desirable to enquire into the extent by which the determination of the percentage of starch by the specific gravity method would be influenced by working on whole as against cut tubers of a variety susceptible to "hollow centre."

For the purpose of this examination the continental variety Hellena was selected since this variety is very susceptible to "hollow centres." From the bulk produce of this variety four grades of tubers were selected, having an average weight per tuber of 286 grms., 184 grms., 88 grms and 52 grms. respectively. From each grade fifty random samples of ten tubers each were taken and the percentage of starch in each sample determined (a) without exposing the cavity where present in the potato and (b) after exposing by cutting open all the tubers. The number of tubers with "hollow centres" in each sample was also recorded.

The results obtained are shown on Table V.

The results as shown under four headings, number of tubers with hollow centres per sample, percentage of starch in sample before exposing cavity, after exposing the cavity and the difference due to non-exposure of cavity.

Grade I Tubers. The number of tubers with hollow centres varied from two to nine per sample of ten tubers, 70 per cent of the samples having five or more tubers per sample so affected. The figures for percentage of starch before exposing the cavities show a considerable variation even in the samples which had equal numbers of tubers with hollow centres. This was due to the volume or size of the cavity in each tuber, potatoes with large cavities giving a much lower percentage of starch than those with smaller cavities.

The figures for the fifty samples varied from 10.25 per cent to 17.75 per cent with a mean of 15.47 per cent. The results obtained from these same samples after exposing the " hollow centres " show a much closer relationship, all lying between 17.25 and 19.50 per cent, which may be regarded as a normal variation, see Tables I, III and IV.

The difference between the two sets of results varied from 0.50 to 7.00 per cent of starch, the higher figures being due not only to the number of tubers with hollow centres but to the size of the cavity within the tuber.

The mean results show a difference of 3.03 per cent, which would indicate that failure to expose the hollow centres in this grade of tubers would result in obtaining a figure for the percentage of starch which would be 3.03 per cent lower than that obtainable were there no hollow centres present or if the hollow centres had been exposed.

Grade II tubers. It will be observed that in this case there were only 34 per cent of the samples with five or more hollow centres per sample, a marked reduction from that obtained with the larger tubers. It will also be seen that the variation in the percentage of starch as determined before the cavities were exposed was not as great as that obtained with the larger tubers, being only from 13.00 to 19.50 per cent, with 86 per cent of the samples lying between 16 and 19.5 per cent. This was due to the fact that the size of the cavity in the tubers was very much smaller than that observed in the Grade I tubers.

The figures for percentage of starch as determined after exposing the hollow centres again show a close relationship, all samples except two being between mean of all 17.00 per cent and 19.75 per cent.

The difference in percentage of starch due to the non-exposure of the hollow centres was not as marked as that obtained with the Grade I tubers, there being only two samples showing a difference over 4 per cent, two with a difference of over 3 per cent, the remainder lying between 0.00 and 2.75 per cent.
The mean of all the samples was 1.10 per cent.

THE EFFECT OF "HOLLOW CENTRES" IN POTATO TUBERS IN THE DETERMINATION OF STARCH PERCENTAGE BY THE SPECIFIC GRAVITY METHOD

VARIETY HELLENA.

TABLE V.

Tubers weighing 286 grms.

No. of Tubers in sample with "Hollow Centres"	Starch per cent before exposing "Hollow Centres"	Starch per cent. after exposing "Hollow Centres"	Difference due to "Hollow Centres"
	%	%	%
9-10	13.00	18.00	5.00
9-10	17.25	19.25	2.00
8-10	13.25	18.50	5.25
7-10	10.25	17.25	7.00
"	13.25	17.25	4.00
"	15.75	18.50	2.75
"	16.50	19.25	2.75
6-10	16.00	19.00	3.00
"	14.25	19.00	4.75
"	17.25	19.25	2.00
"	14.50	17.25	2.75
"	13.00	18.75	5.75
"	14.00	18.00	4.00
"	17.00	19.00	2.00
"	16.00	18.75	2.75
"	16.50	18.75	2.25
"	14.50	19.25	4.75
"	18.00	19.00	1.00
"	15.25	19.50	4.25
"	15.75	18.50	2.75
"	11.75	18.00	6.25
5-10	14.25	18.75	4.50
"	14.00	18.75	4.75
"	15.00	19.00	4.00
"	15.75	18.75	3.00
"	16.50	18.75	2.25
"	14.50	18.00	3.50
"	14.50	16.75	2.25
"	16.75	18.75	2.00
"	14.50	18.00	3.50
"	16.00	18.00	2.00
"	17.00	18.75	1.75
"	17.50	19.00	1.50
"	15.75	18.25	2.50
4-10	15.75	18.75	3.00
"	15.25	18.00	2.75
"	16.00	18.75	2.75
"	16.25	18.50	2.25
"	16.75	18.75	2.00
"	15.75	18.00	2.25
"	17.00	19.00	2.00
"	14.25	19.00	4.75
"	15.00	17.50	2.50
"	14.50	18.00	3.50
"	18.25	18.75	0.50
3-10	14.50	17.50	3.00
"	16.50	17.25	0.75
"	16.25	18.50	2.25
"	18.75	19.50	0.75
2-10	17.75	19.75	2.00
Mean	15.47	18.50	3.03

Tubers weighing 184 grms.

No. of Tubers in sample having "Hollow Centres"	Starch per cent before exposing "Hollow Centres"	Starch per cent. after exposing "Hollow Centres"	Difference due to "Hollow Centres"
	%	%	%
7-10	17.50	18.75	1.25
7-10	15.25	18.75	3.50
6-10	17.00	18.75	1.75
"	13.00	17.50	4.50
"	16.25	18.75	2.50
"	16.25	18.50	2.25
"	17.50	18.75	1.25
"	17.00	18.75	1.75
"	15.00	17.00	2.00
"	17.25	19.50	2.25
5-10	14.25	18.50	4.25
"	17.00	19.25	2.25
"	16.50	17.75	1.25
"	16.50	18.00	1.50
"	15.25	18.75	3.50
"	18.50	19.50	1.00
"	15.75	17.75	2.00
4-10	16.00	18.75	2.75
"	14.50	16.50	2.00
"	17.25	18.75	1.50
"	18.50	19.00	0.50
"	16.00	18.75	2.75
"	17.75	19.25	1.50
"	17.50	19.50	2.00
"	17.75	19.00	1.25
"	16.00	18.00	2.00
"	16.50	18.75	2.25
"	17.25	18.75	1.50
"	17.00	18.50	1.50
"	17.50	18.50	1.00
"	17.00	18.75	1.75
3-10	18.75	19.25	0.50
"	18.25	18.75	0.50
"	18.50	18.75	0.25
"	18.00	19.50	1.50
"	16.00	18.25	2.25
"	18.75	19.25	0.50
"	18.00	18.75	0.75
"	16.75	18.75	2.00
"	17.50	19.00	1.50
"	17.75	18.75	1.00
2-10	18.50	19.25	0.75
"	18.00	18.50	0.50
"	17.25	19.00	1.75
"	18.00	19.25	1.25
"	18.50	19.00	0.50
"	19.50	19.75	0.25
"	14.50	16.00	1.50
1-10	18.75	18.75	0.00
0-10	19.25	19.25	0.00
Mean	17.06	18.66	1.60

Tubers weighing 88 grms.

No. of Tubers in sample with "Hollow Centres"	Starch per cent before exposing "Hollow Centres"	Starch per cent. after exposing "Hollow Centres"	Difference due to "Hollow Centres"
	%	%	%
5-10	18.25	18.75	0.50
4-10	15.75	16.50	0.75
"	16.25	17.25	1.00
3-10	18.00	18.75	0.75
"	16.50	17.50	1.00
"	17.75	18.25	0.50
"	18.00	18.50	0.50
"	18.00	18.25	0.25
"	17.00	17.50	0.50
"	15.75	17.75	2.00
"	18.50	18.75	0.25
"	18.00	18.50	0.50
2-10	17.25	17.50	0.25
"	18.25	18.75	0.50
"	18.75	19.25	0.50
"	17.50	18.25	0.75
"	19.00	19.50	0.50
"	14.25	16.25	2.00
"	16.50	17.25	0.75
"	14.00	15.75	1.75
"	17.50	17.75	0.25
"	17.50	18.50	1.00
"	18.50	18.75	0.25
"	17.00	17.50	0.50
"	15.25	18.50	3.25
"	17.25	18.50	1.25
"	17.50	17.75	0.25
"	18.00	18.25	0.25
"	17.50	18.25	0.75
"	18.00	18.00	0.00
"	15.00	16.25	1.25
"	17.25	17.50	0.25
1-10	18.00	19.00	1.00
"	17.25	17.50	0.25
"	18.50	18.75	0.25
"	19.00	19.00	0.00
"	17.50	18.25	0.75
"	18.00	18.75	0.75
"	15.75	15.75	0.00
"	18.25	18.50	0.25
"	17.75	18.75	1.00
0-10	19.50	19.50	0.00
"	18.75	18.75	0.00
"	19.25	19.25	0.00
"	18.50	18.50	0.00
"	17.50	17.50	0.00
"	18.00	18.00	0.00
"	17.75	17.75	0.00
"	18.75	18.75	0.00
"	18.25	18.25	0.00
Mean	17.51	18.09	0.58

Tubers weighing 52 grms.

No. of Tubers in sample with "Hollow Centres"	Starch per cent before exposing "Hollow Centres"	Starch per cent. after exposing "Hollow Centres"	Difference due to "Hollow Centres"
	%	%	%
3-10	16.00	16.75	0.75
2-10	15.00	15.50	0.50
"	13.00	13.30	0.30
"	17.40	18.50	1.10
"	16.00	16.75	0.75
"	14.00	14.75	0.75
"	15.50	16.00	0.50
"	13.75	14.75	1.00
"	17.00	17.40	0.40
"	12.75	15.25	2.50
1-10	17.75	18.65	0.90
"	15.50	16.00	0.50
"	17.00	17.00	0.00
"	17.40	17.75	0.35
"	17.50	17.50	0.00
"	14.25	14.60	0.35
"	15.00	15.00	0.00
0-10	17.40	17.40	0.00
"	15.75	15.75	0.00
"	17.00	17.00	0.00
"	16.75	16.75	0.00
"	19.00	19.00	0.00
"	14.00	14.00	0.00
"	17.40	17.40	0.00
"	15.25	15.25	0.00
"	17.75	17.75	0.00
"	14.75	14.75	0.00
"	17.50	17.50	0.00
"	18.00	18.00	0.00
"	15.50	15.50	0.00
"	17.40	17.40	0.00
"	17.50	17.50	0.00
"	17.40	17.40	0.00
"	17.20	17.20	0.00
"	16.50	16.50	0.00
"	17.75	17.75	0.00
"	17.75	17.75	0.00
"	15.75	15.75	0.00
"	16.00	16.00	0.00
"	16.30	16.30	0.00
"	15.75	15.75	0.00
"	15.50	15.50	0.00
"	16.75	16.75	0.00
"	16.50	16.50	0.00
"	17.50	17.50	0.00
"	15.75	15.75	0.00
"	15.75	15.75	0.00
"	16.00	16.00	0.00
"	19.25	19.25	0.00
"	17.40	17.40	0.00
Mean	16.33	16.54	0.21

Grade III Tubers. There was only 24 per cent. of the samples having more than two tubers with hollow centres per sample, indicating the reduction in the occurrence of " hollow centres " with decreasing size of tubers.

The percentage of starch in the different samples as determined before exposing the hollow centres shows a much closer relationship than that obtained with the Grades I and II tubers, 86 per cent. of the samples lying between 16.25 and 19.25 per cent., due to the fact that with the exception of one or two cases the " hollow centre " cavity in the tubers was very small. The mean for all samples was 17.51 per cent. The percentage of starch as determined after exposing any hollow centres present again show a close agreement between the different samples, all except two lying between 16.25 and 19.50 per cent. The mean for all samples was 18.09 per cent.

The difference due to the non-exposure of the hollow centres varied from 0.00 per cent. to 2.00 per cent. with one exception in which the difference was 3.25 per cent. The mean difference was 0.58 per cent. indicating that the error in starch determination by the specific gravity method, due to the non-exposure of the cavities or " hollow centre " is considerably reduced in the case of tubers of the size and weight included in Grade III.

With a smaller grade of tuber averaging 52 grms. per tuber the difference due to non-exposure of "hollow centres" varied from 0.00 to 2.50 per cent and the number of tubers with "hollow centres" per sample varied from 1 to 3. Out of the fifty samples examined only seventeen had tubers with "hollow centres" and sixteen of these samples only showed a difference of between 0.00 and 1.10 per cent. due to non-exposure of the "hollow centres". This may be regarded as negligible.

The Effect of Storage on the Percentage of Starch in Potatoes.

Should the growing of potatoes for the production of industrial alcohol become as extensive as is the growing of sugar beet for the production of sugar, it would be necessary to store some of the potatoes until such time as the factories would be able to take delivery of them. In the case of the sugar beet the crop is usually left in the soil until the factory is ready to receive it, but with potatoes other measures should be adopted since the potato is so susceptible to injury by frost and other agencies. In general farm practice the produce of the potato crop is lifted before the heavy winter frosts set in, and the potatoes after being rid of diseased tubers are placed in pits or clamps amply protected against the access of rain water or damage by frost. Since potatoes for industrial alcohol production are usually purchased by the factories on a starch content basis it is of interest both to the growers and to the manufacturers to know to what extent, if any, changes may take place in the percentage of starch in the tubers during the storage period.

Accordingly, it was arranged to carry out an experiment in which monthly determinations were made of the percentage of starch in two different varieties of potatoes one of medium and one of high starch content. The experimental period extended from the time the potatoes were lifted in October until the corresponding date in March of the following year. The potatoes were stored in a pit or clamp covered with straw and a layer of clay which was then thatched to keep off the rain. The pit was opened about the same date in each month and a bulk sample taken, after which it was again closed. Each sample was divided into three representative sub-samples and the percentage of starch in each was determined. The results obtained are shown on Table VI.

TABLE VI.

EFFECT OF STORAGE ON THE PERCENTAGE OF STARCH IN POTATOES.

Sample	VARIETY PARNASSIA.						VARIETY HELLENA					
	Date of Sampling						Date of Sampling					
	October	November	December	January	February	March	October	November	December	January	February	March
	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch
1	17.75	16.40	16.50	14.50	16.70	16.40	18.00	19.50	18.25	18.83	18.49	20.25
2	16.75	15.75	16.40	16.00	15.60	15.50	17.20	18.00	18.00	18.50	18.06	18.83
3	18.25	16.30	16.00	14.75	16.50	17.00	18.00	18.50	18.83	18.00	17.50	20.37
Mean	17.58	16.15	16.30	15.08	16.27	16.30	17.73	18.66	18.36	18.44	18.02	19.82

The variety Parnassia shows a reduction in percentage of starch from the time of lifting the potatoes in October until the date of the second determination which was made one month later. There was a slight rise in starch recorded at the December tests, followed by a marked fall in January and a gradual rise in February and March. The figures obtained at the final tests in March were lower than those of the first test in October being 16.30 and 17.58 per cent. respectively. In the case of Hellena the November figure was higher than that of October, a slight fall in December, an increase in January followed by an appreciable fall in February and a marked increase in March. The figure for the latter month was much higher than that of October, the figure being 19.82 and 17.73 per cent. respectively.

Generally, the results show that potatoes stored in a pit or clamp under ordinary farm conditions tend to reduce in starch up to January and February and increase in starch in March. Further data in this connection were obtained by determining the percentage of starch in five different varieties of potatoes at three different dates between the time of lifting and the second week of May.

The potatoes were stored in a pit or clamp at time of lifting and samples were taken for starch determination during the second week of December, the first week of February and finally in the second week of May.

The results obtained are shown on Table VII.

TABLE VII.

EFFECT OF STORAGE ON THE PERCENTAGE OF STARCH IN POTATOES.

	Var. Hellena.			Var. Parnassia.			Var. Arran Banner			Var. Arran Consul			Var. Kerrs Pink		
	Date of Sample			Date of Sample			Date of Sample			Date of Sample			Date of Sample		
Sub-Sample	11-12-37	5-2-38	11-5-38	11-12-37	5-2-38	11-5-38	11-12-37	5-2-38	11-5-38	11-12-37	5-2-38	11-5-38	11-12-37	5-2-38	11-5-38
	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch	% Starch
1	17.00	17.40	18.83	18.50	16.75	18.83	12.50	12.00	11.85	13.75	14.00	13.50	16.75	16.30	18.00
2	17.50	17.50	18.65	18.50	17.40	18.83	11.85	11.25	11.70	13.50	13.15	14.00	16.30	16.40	17.20
3	17.20	17.40	18.25	17.75	18.00	18.50	12.25	11.85	12.25	13.75	14.00	14.50	16.40	16.00	16.50
4	16.40	16.40	18.50	18.00	17.40	18.83	12.25	11.70	12.00	13.30	13.50	13.00	17.00	15.50	16.40
Mean	17.03	17.18	18.56	18.19	17.39	18.75	12.21	11.70	11.95	13.58	13.66	13.75	16.61	16.05	17.03

The varieties may be classified into three groups, viz., high, medium and low starch. It will be seen that, with the exception of Hellena and Arran Consul, the results show a reduction in starch from December to February and a rise in starch from February to May, which was applicable to all the varieties. The varieties Hellena and Arran Consul show an increase in the percentage of starch from December to February. The average of all results show a fall from December to February and a rise from December to May, thus agreeing generally with the results outlined on Table VI.

DISCUSSION.

The possible influence of size of tuber on the percentage of starch in potatoes indicated in the earlier investigation (1) is clearly outlined in the results of tests carried out in this connection, Tables I, III and IV. The potatoes under examination included varieties of a high, medium and low percentage of starch and the results generally show a falling off in the percentage of starch with decreasing size of tuber.

It will be observed, however, that results differing from this general conclusion were obtained with the variety Parnassia, Table I, while results in agreement with it were obtained from the same variety in a later test, Table IV. It may be noted here although it is not given as a full explanation of the differing results obtained with this variety, that the particular strain of Parnassia from which the results on Table I were obtained had a high degree of virus infection; while that from which the results on Table IV were obtained was practically free from virus infection.

The results also indicate the necessity of procuring representative samples of tubers from bulk consignments so as to obtain accurate figures for the percentage of starch, which is an important consideration where potatoes are purchased for industrial purposes on a percentage of starch basis, determined by the specific gravity method.

With regard to the production of the highest proportion of ware potatoes consistent with total yield, it would appear that this is dependent upon the allocation of an optimum area per plant, having due regard to the selection of seed, sprouting of seed, cultivation, manuring and subsequent treatment. The results, Table (2), obtained in the spacing trials with Arran Banner, indicated that the most suitable width of drill for this variety was 26 inches, since the 24 inch drill did not provide sufficient cover for the developing tubers of this prolific variety, and that the optimum distance between the plants was 9 inches, which gave a total yield of more than 1.5 tons over that obtained with the 12 and 15 inch spacing. It will have been observed, however, with regard to the grade of tuber that the 15 inch spacing gave the highest and the 9 inch spacing the lowest percentage respectively of large tubers but if the figures for large and medium tubers are combined the relative total yields would be

15.88, 15.10 and 14.96 tons per acre respectively for the 9, 12 and 15 inch spacings. These results, therefore, indicate that for the variety Arran Banner the highest total yield and highest yield of ware potatoes was obtained from a 9 inch spacing in 26 inch drills.

In connection with the influence of " hollow centres " on the determination of the percentage of starch by the specific gravity method the results outlined on Table V. indicate quite clearly the necessity of examining tubers for the presence of cavities and for the exposing of such cavities before determining the percentage of starch. Failure to carry out this may result in errors amounting to as much as 7 per cent. which would make a marked difference in the buying price of the potatoes where they are purchased for industrial purposes on a percentage of starch basis, and this might easily represent the difference between profit and loss in the production of the crop.

The magnitude of the error in the percentage of starch due to the non-exposing of the " hollow centres " is dependable upon the size of the cavity and the number of tubers so affected. Large tubers are more likely to be affected in this way and usually possess "hollow centres" of greater size than those obtained in the smaller grade tubers. This is borne out by the figures obtained for the large tubers in comparison with those obtained in the other grades, the figures obtained being, 3.03, 1.60, 0.58 and 0.21 per cent respectively. In view of the close relationship between the results obtained from the different samples in each grade after exposing the hollow centres, it would appear that the presence of "hollow centres" does not materially affect the actual percentage of starch in the tubers.

With regard to the change in the percentage of starch of potatoes when stored under good conditions in a pit adequately protected against climatic conditions, it appears that generally a slight reduction in the percentage of starch is incurred for the first couple of months after pitting the crop and that this is followed by a slight increase during the next two or three months.

SUMMARY.

I. The results of an investigation into the relationship between size of tubers and percentage of starch for potatoes of high medium and low starch content are outlined and discussed. It appears that where potatoes are grown under normal conditions the higher the proportion of ware potatoes in the produce the higher the percentage of starch indicating the desirability of obtaining the maximum weight of ware potatoes in the produce.

II. Attention is directed to the variation in the percentage of starch that occurs from sample to sample of the different grade tubers within a variety indicating the necessity for the careful sampling of potatoes for the

determining of the percentage of starch within a reasonable degree of accuracy.

III. Results from a variation in the area per plant are shown and the optimum area per plant for the variety under examination is pointed out, in which the highest yield of ware potatoes was obtained.

IV. Certain varieties of potatoes are subject to an abnormality known as "hollow centre", which does not appear to influence the actual percentage of starch in tubers so affected, but which would considerably influence the results obtained by the specific gravity method unless such cavities had been exposed previous to the determination. The error incurred is greater with large tubers so affected than with smaller ones.

V. Certain changes take place in potatoes during storage in pits under good conditions, amongst which are changes in the percentage of starch. Figures for the monthly variation in the percentage of starch are shown as well as confirmatory figures obtained in a further test made over a period of from five to six months. Generally, the percentage of starch falls up to December or January after which it increases up to May.

Acknowledgment is gratefully made to F. P. Hussey, B.Agr.Sc., B.Sc.(Econ.) for his assistance with the statistical work on the investigation.

(1) Drew and Deasy, J. Dept. Agric., Dublin, 36 No. 2, 1939.

Tithe Applotment Books of 1834.

AGRICULTURAL RETURNS: PRODUCE AND PRICES

INTRODUCTORY NOTE by ROBERT C. SIMINGTON
(*Editor*, *Civil Survey of Ireland, A.D.* 1654-56).

The Agricultural Returns for six southern parishes of Tipperary county, published at pages 255-327 of this Journal, came to light in the course of the examination made on behalf of the Irish Manuscripts Commission of the extensive collection of Tithe Composition Applotment Books, of date 1823-1837, preserved in the Record Branch of the Land Commission. The information presented in the South Tipperary sections of these books includes particulars in respect of each holding, of the acreage (Irish measure) under wheat, oats, barley, potatoes, pasture and fallow ; each parish book also contains particulars of the valuation of every landholder's farm supplemented by an account of the rents paid where these had been ascertained. In conjunction with this specification of the agricultural employment of the land the figures are given of Tithe Composition for each parish as well as for each landholder. All these particulars were written down in the course of the summer of 1834, that is, some thirteen years before the regular collection of agricultural statistics was begun and some three years prior to the Poor Law Valuation.[1] In this Tipperary Ms. collection of Tithe Composition Applotment Books a further document was discovered setting out the "acreable produce," with prices, of some small farms for three successive years, 1828, 1829 and 1830. While the existence of the entire collection of these Tithe Composition documents, which are available for the whole country, and are widely informative as regards topography and landholding, has been made known to students through the medium of *Analecta Hibernica*,[2] it was considered that the exceptional information afforded for south and south-eastern Tipperary should be the subject of a special communication to this Journal. On the initiative of the Chairman of the Irish Manuscripts Commission, Professor Eoin MacNeill, D.Litt., the necessary preliminary investigation was instituted at the request of the Minister for Agriculture, the consent to publication of the original text being readily forthcoming from the Minister for Lands.

The areas represented by these Parish Applotment Books—a title deriving from the relative legislation directing assessment and applotment—are the parishes of Carrick-on-Suir, Kilmurry, Kilsheelan (partly in Waterford), Kilcash

1—A.D. 1837 (1 & 2 Vict. cap. 56).
2—Vol. X, p. 293, 1941, published by the Stationery Office for the *Irish Manuscripts Commission*.

Kiltegan and Derrygrath, all located for the greater part immediately north of the river Suir, below the range of Slievenamon, and extending from Carrick town to the districts around Clonmel. Within the barony of Iffa and Offa and linked through its fertile soil with the *Golden Vein* of the neighbouring regions of Middlethird and Clanwilliam, the areas covered by the text belonged to one of the most productive portions of Tipperary.[3] A description[4] almost contemporary with the period of the text classifies the husbandry of the county into five districts, three "agricultural" districts occupying the plains and two of "pasturage" comprising the mountain tracts: "The principal of the former is the plain from Carrick to Tipperary, the superior quality of the soil of which, and its contiguity to Clonmel, the great mart for export, have caused it to be occupied by the more wealthy class of landholders, in farms averaging from 50 or 60 acres, though sometimes considerably more; here the lands under tillage exceed the quantity of pasture in the proportion of five to three." Within this third decade of the 19th century O'Donovan visiting, in pursuit of their place-names, the parishes of the text, also noted their agricultural features, his observations being preserved in the *Ordnance Survey Field Name Books*.[5] A sample of these for the parish of Derrygrath may be given: "Agriculture: Excellent cultivation here in every townland; wheat oats, barley, potatoes, turnips, etc. Rich in corn and cattle and abounding manhood." Likewise Arthur Young, in the previous century,[6] journeying from Cashel to Clonmel, found "the same rich loamy soil the whole way." "I examined," he says, "the soil in several fields and found it to be of an extraordinary fertility. A great wheat area this especially towards Clonmel." Of Carrick-on-Suir in the extreme south-east of the county a not less pleasing picture was drawn[7] some few years subsequent to 1834: "The parochial surface is all a part of the nearly level valley of the Suir—part of an expanse of it which, for luxuriance, fertility and garden-like embellishment and beauty is not surpassed in the three Kingdoms." The agriculture of some two and three centuries previous to these descriptions is recorded by the Tipperary *Civil Survey*[8] of A.D. 1654. There the estimated areas of the townlands in the classifications of arable, pasture and meadow are specified; the frequent noting, however, of "All Arable" is significant of the nature of the employment of the farms over many areas within the boundaries of our six parishes, and, for that matter, of the whole county.

It is of this land reaching along and beyond the north bank of the Suir and

---

3—In "*A Journey throughout Ireland in* 1834" by H. D. Inglis, Whittaker, London, 1835 Tipperary is described as "one great granary"; the "corn mills at Clonmel . . . are like the great factories . . . in the English manufacturing districts, and employ almost as many persons"; the population of the town is estimated at 18,000. "The slopes of the hills which form the right bank of the Suire, and which, opposite to Clonmel are of very considerable altitude, are cultivated almost to the summit . . ."

4—*A Topographical Dictionary of Ireland*, by Samuel Lewis, Vol. 11, p. 630, London 1837.

5—The original books are preserved at the Ordnance Survey, Phoenix Park; copies are available in the National Library.

6—"*Tour in Ireland*," Vol. 1, p. 394, ed. by Hutton.

7—See the "*Parliamentary Gazetter of Ireland*" (1844-1845) under Carrick-on-Suir.

8—Vol. 1, *Eastern and Southern baronies*; pub. by Stationery Office for *Irish Manuscripts Commission*.

containing in the rural areas some 6,930 persons,[9] that the Tithe Composition Books, compiled midway in the decadal period 1831-1841, set down the wide range of facts now brought within the reach of students and investigators of agricultural history. To make such facts available in a manner that would be clear and concise, and at the same time to adhere as closely as possible to the original text, the form in which they now appear was specially designed. Where in manner of presentation it has varied from the original text explanation in due course, and at its proper place, will be forthcoming. Here, a brief survey of the agricultural and land-holding data derived from the relative six Applotment Books may be given by way of more intimate and definite description of the conditions to which the Tithe Composition proceedings, presently to be explained, would apply.

In statute measure, the total area involved was 25,864 acres. Excluding plantations, woodlands and heathy pasture, such being frequently grouped together and undistinguished in area, tillage represented 55 per cent. and pasture 45 per cent of that area. Taking the parishes individually, the returns disclosed that the area of greatest tillage was the parish of Derrygrath, situated on the road from Clonmel to Cahir, the proportion being, in this classification, 67.73 per cent. In Carrick-on-Suir the areas in both pasture and tillage were nearly the same ; in Kiltegan parish,[10] near Clonmel, pasture exceeded tillage by about 12 per cent ; in the remaining parishes the percentages of the areas in tillage were, Kilmurry 52 per cent ; Kilsheelan 52 per cent ; and Kilcash 58 per cent.

Large farms were numerous, particularly in the parishes of Kilmurry and Kilsheelan ; in the former there were 12 farms of from 40 to 50 Irish acres and 24 of from 50 to 100 Irish acres ; in the latter, there were 11 farms of from 30 to 50 Irish acres and 12 in the category of 50 to 100 Irish acres ; here also were some large holdings above 100 acres, mainly in pasture. In point of number the smallest farms were in the parish of Carrick-on-Suir, farms of 5 Irish acres and under representing 60 per cent. of the total holdings of the parish. In Derrygrath, the outstanding tillage area, farms of 5 Irish acres and under were 28 per cent ; those exceeding 5 and not exceeding 10 acres, 26 per cent ; those exceed ing 10 and not exceeding 15 acres, 13 per cent ; those exceeding 15 and not exceeding 20 Irish acres, 8 per cent.

The total number of holdings[11] in the six parishes was 627 ; of these 77 per cent were below 30 Irish acres.

9—This total for the six parishes is taken from the *Census* of 1831 ; the pop. of the town of Carrick was then 6,922. With regard to the latter "the trade in corn and butter, the produce of the surrounding district is stated in a petition to Parliament presented by the inhabitants in 1832 to amount at that time to £240,000 and previously to have exceeded £360,000 per annum." Lewis, *op cit.*, at Carrick-on-Suir.

10—Lewis, *op cit.*, notes "the lands which are chiefly arable are generally in the occupation of experienced farmers and consequently under an improved system of cultivation. Limestone is quarried chiefly for burning and there are indications of coal in sinking for which wavelite was discovered of which some beautiful specimens were procured."

11—Holdings of 5 acres and below 5 acres (Irish measure) represented 30 per cent ; above 5 and not exceeding 10 acres 18 per cent. ; above 10 and not exceeding 15 acres, 10 per cent ; above 15 and not exceeding 20 acres, 9 per cent ; above 20 and not exceeding 25 acres, 6 per cent ; above 25 and not exceeding 30 acres, 4 per cent.

For the easy and immediate consultation of other facts recorded by the six Applotment Books summary tables have been prepared which appear at the pages indicated.[12] Agricultural methods in these areas, prevailing down to the years 1861-1865 are described in a recent publication: " Wheat was sown in six-sod ridges—oats in wider ones (*seatai*). Both ridges and *seatai* were covered in with the shovel when sown. This culture was the secret of successful corn-growing before the decline of tillage in the sixties and seventies of the last century."[12a] So much by way of introduction to the terrain, the subject of Tithe proceedings of 1834.

It is quite outside the province of this note to attempt the history of tithes and their collection in Ireland.[13] The purpose of this note is merely to indicate, in the briefest manner, the origin of the Ms. books containing the Agricultural Returns and to refer to the material they provide for the study of the relationship of Tithes and Tithe Composition to productive capacity. Only what is necessary for an understanding of the figures furnished by the text will be stated here— first in the light of the subject in general and then in particular relation to the six parishes.

In the third and fourth decades of the 19th century legislative measures were enacted for the purpose of establishing compositions for tithes[14]; that is to say, for the fixing of annual incomes payable to tithe-owners on defined principles. The expressed aims of the first Act, passed in 1823, were the encouragement of farmers and occupiers of land, the rendering of the incomes arising from tithes more certain in amount and more easy of collection and finally towards ending the controversies then existing. Prior to the passing of this Act the articles

---

12—(1) A recapitulation for each parish showing the total areas of each townland, as well as of the parish itself, in the Agricultural classifications set out; this appears at the end of each parish text. For guidance the total areas have been reduced to statute measure in each instance, the Irish measure being retained and shown distinctively. (2) a summary of the six parishes showing their total area with relative percentages in the various agricultural classifications; this appears at p. 343; (3) a statement showing the total area of each parish applotted with Tithe Composition, the amount of the valuation, proportion of tithe to valuation and average assessment per acre (p. 339). As the valuation was given per acre it was necessary to calculate the valuation of each holding to arrive at a total figure. Tables reducing Irish Land Measures to Statute and showing the comparative values of both measures are presented to enable calculations to be made over individual farms (p. 342).

12*a*—*Patrick Lyons*, Clonmel in Béaloideas (Vol. X, p.291, 1940). The writer furnishes many interesting details: "The reapers worked in pairs, the best man of the squad being called "the Captain" of each pair . . . the senior went first, having his left side foremost. His comrade followed on the opposite side of the ridge, having his right side foremost. . . . Four reapers were supposed to sever an Irish acre in a day . . . One female binder was the allowance to every two reapers . . . In a great *meitheal* the writer has heard of seventy men reaping . . . The men of the Nire (Co. Waterford) used to go in a squad of a hundred or so to Carrick-on-Suir annually to purchase their reaping-hooks."

13—" The payment of tithes was first enjoined in Ireland by the Synod of Kells in A.D. 1152 but it was not till the Synod of Cashel in A.D. 1172 that they became a regular part of the system of the Church."—Shirley, " *Historical Sketch Endowments of the Church of Ireland,*" p. 164; *cf.* also Doyle, Bishop of Kildare and Leighlin, p.292 *Select Committee on Tithes* 1832 for proc. of Synod of Dublin 1186; originally "voluntary oblations for support of clergy and poor"; see also, " *The History of Tithes* . . . " by J. D'Alton, Dublin, 1832.

14—The two principal Acts were (1) 4 *Geo. IV.* c. 99 entitled " An Act to provide for the establishing of compositions for tithes in Ireland for a limited time." (19th July, 1823) and known as Goulbourn's Act; (2) 2 & 3 *Wm. IV. c.* 119 being an "Act to amend three Acts . . . and to make compositions permanent" (16 August 1832) commonly known as Stanley's Act.

titheable as well as the manner of the payment of tithe were both governed by the varying customs prevailing over the parishes of the country. Neighbouring parishes and, for that matter, neighbouring lands, differed in their tithes as well as their mode of tithing. Articles titheable included grain of all kinds, hay, rape, flax, potatoes, sheep, orchards and in some regions brood mares, milch cows, sheep or lambs.[15] A resolution of the Irish House of Commons of March, 1735, had the effect of preventing tithe-owners from demanding the tithe of agistment and from that year the demand for tithe was confined to the tillage farms.[16] Over northern and southern Tipperary the articles titheable included grain, meadowing, potatoes and orchards. Defined as the tenth part of the increase arising and renewing yearly either from the profits of the land, the stock upon lands, or men's personal industry, tithes were paid to the tithe-owners in one of three ways : (1) in kind, (2) by way of pecuniary equivalent at an acreable rate or (3) by "view" of the growing crops at so many barrels to the acre. While it has been stated by a writer[17] whose office conferred the widest sources of knowledge " that in no case whatever is the tithe paid to the full extent," it was testified[18] before a Parliamentary Select Committee of 1832 that "in some places the tithe exceeded one-tenth part of the produce and in other places that it was not half as much." In these diverse circumstances the investigator must examine the documents for each parish, where they may be available, to determine the exact relationship of the tithe to the produce before the introduction of the 19th century legislation. A fairly general arrangement over many parts of the country, prior to 1823, and concurrent with the practice of annual valuation by "view" of the crops, was the payment of a pecuniary equivalent at the following rates[19] per Irish acre : 12/- for wheat with the same rate for potatoes and barley ; oats 8/- to 9/- and meadow 6/- to 7/-.

15—*cf.*, App. pp. 561-624, *Select Com. on Tithes*, 1832 (compiled by John Caillard Erck).

16—" Legal proc. being taken to enforce the demand (for the tithe of agistment) judgment was in every instance given both in the Irish and English courts in favour of the claim ; upon which the House of Commons (composed principally of the landed proprietors themselves) passed a resolution condemnatory of the demand and encouraging opposition to it."—Edwards, '*Historical Sketch of the Church of Ireland*, p.126. And see, Shirley, *op. cit.*, p. 168 : " In the year 1735 . . the Church received a very severe blow . . by the abandonment of the payment of " Agistment tithe " or tithe payable . . on pasturage, the condition at that time of the greater part of the land in Ireland." The Irish Act 40 Geo. 3 c. 23 (1800) recites " that tithe-agistment had not been demanded for more than sixty years then last past " and it enacts " that no claim shall be allowed for that kind of tithe, nor any suit be entertained in any court . . for recovery of the same." But it goes on to provide " that nothing in the Act shall exempt from the payment of tithe any kind of cattle in any parish in which tithe now is or has been usually paid within the last ten years." See O'Leary, p.151, *The Law of Statutable Composition*, Dublin, 1834.

17—John Caillard Erck, LL.D., Sec. to H.M. Commissioners of Ecclesiastical Enquiry.

18—*cf.*, evidence of the Most Revd. Dr. Doyle, Bishop of Kildare and Leighlin, *Select Com. on Tithes*, 1832, at q. 3164.

19—The rates decreed in the Consistorial Courts should also be consulted. The Registrar of the Court of Waterford and Lismore certified that in the year 1815-1816 the lowest value that was proved and decreed for wheat and potatoes was 10/- per Irish acre and the highest £1 per acre; the lowest for oats 6/- and the highest 15/- ; likewise for the period from 1816 to 1822 the figures are given. In the neighbouring diocese of Cashel the procedure was on a different basis : "Whenever the clergy of the diocese . . . are obliged to issue citations for the recovery of their tithes, they generally make their charges by the barrel ; and as the prices of wheat, potatoes and oats vary considerably every year they are guided by the market price of each in the neighbourhood." The wheat lands of Meath were decreed up to and including a rate of £1 7s. per acre. See *Tithes, Legal Proceedings*, *Par. Pub.* 1822.

One or two examples may be given to illustrate the relationship of these rates to the produce. The value of an Irish acre of potatoes producing 60 barrels of 20 stone—a very general return at the time— at 2½d. per stone would be £12 10s; if the full tithe payment were made it would be £1 5s. The rate, however, was 12/-, the ratio of this to the produce of the Irish acre being about one-twentieth. Similarly the value of an Irish acre of wheat producing seven barrels of 20 stone at 25/-, then a low price, would be £8 15s.; the ratio of the 12/- rate in this case to the produce would be nearly one-fifteenth. Where, on the other hand, the mode of tithing was by "view" of the crops, the demand for tithe was in proportion to the output—the greater the produce the greater the amount of tithe, a factor influencing to no small extent the introduction of the legislation which now may be noticed.

Under the Act of 1823 the necessary machinery was provided by virtue of which the tithe-owners as well as the landholders and owners might elect two commissioners representing their respective interests for the purpose of carrying out, in each parish, the provisions of the Act.[20] The amount of the yearly sum which was to constitute the composition henceforth to be payable to the tithe-owner—the incumbent or impropriator, as the case might be—was to be fixed by these commissioners in either of two ways: (1) by valuation[21] based on average income and average corn prices over the years 1814 to 1821 or (2) by agreement[22] between the incumbent and the vestry, the latter being representative on a certain rateable basis of the owners and occupiers of the parish. It was specially provided by the Act that pasture land, formerly exempt, should be made subject to tithe.[23] By an Act of the following year (5 Geo. IV. c. 63) roads, canals, or waste lands on the side of them were exempted from assessment. Compositions fixed by valuation were to endure for a period of twenty-one years, subject to triennial and subsequently, under the Act of 1824, to septennial variations according to fluctuations in the price of corn; compositions fixed by agreement were to continue for a similar period but without the right of variation. The commissioners were empowered "to cause a survey and admeasurement[24] to be made of all the lands and grounds in any such parish and an estimate of the annual value of all such lands as should not be tithe free[24a] and of the amount of composition for tithes to be made payable in and for such parish."

The manner in which the Act had been received up to 1832, prior to the passing of the Act of that year, was stated thus:

20—5 Geo. IV, c. 63 Secs. I to XV.
21— „ Secs. XVI.
22— „ Sec. XXVII.
23— „ Sec. XXXV. "No land, nor the occupier of any land . . . shall be exempted from any assessment or applotment . . . upon the ground that dry or barren cattle have been fed or agisted on such land . . . "
24— „ Sec. XXI.
24a—"The lands that are tithe-free in Ireland are very inconsiderable and small in extent; in fact, it was only those lands which had been granted to the monasteries in *proprios usus*, and which they kept and manured at their own proper cost, or which were for the support of their own table, *ad mensam* that claimed the privilege of being tithe-free "—Erck—*Select Com.* 1832, p. 177; see, however, *D'Alton op-cit.*, p. 16 as to extent of exemptions at a much earlier period.

"The principal burden of the Tithe Composition Act (1823) arises out of the selection of the years 1814 to 1821 as those upon which the averages should be taken to fix the amount of income to the clergyman which should be made up by the Parish. It is true that the amount is subject to revision . . . but if a valuation be *now* made under the Act, it must be framed in the first instance upon the gross amount exhibited in the clergyman's books for those seven years and at the expiration of seven years, the sum to be applotted on the revision will depend on the price which corn may then bear compared with that which it bears at present. The great proportion of compositions therefore have been under the other alternative allowed by the Act of an agreement without an actual valuation for a gross sum to be applotted and to remain unaltered for 21 years."[25]

For those parishes which had not adopted the facilities provided by the Act of 1823, the Act of 1832 was specially designed.[26] It swept away the privilege of reaching a composition by agreement as well as the pre-existing arrangements for the appointment of commissioners by election and nomination, substituting the appointment, at the hands of the Lord Lieutenant, of a single commissioner for each parish.[27] When made, such appointment would carry with it all the powers, conferred by the first Act, of taking evidence on oath and statements of income and of carrying out surveys and valuations. A new septennial period was instituted for the calculations of the averages of income and corn prices, viz. 1823-1830. The relevant section (1) may be quoted " After the passing of this Act the amount of any and every composition to be . . . established in lieu of tithes . . . in any parish . . . shall be calculated upon an average of all the sums paid or agreed for or adjudged to be paid on account of the tithes of the parish to which such composition shall relate during the seven successive years next preceding the 1st November, 1830 . . . and the certificates stating the average prices of corn shall refer to such successive years." Under this Act the Tithe Composition Applotment was completed over the entire country; under it, likewise, were fixed the compositions for the six parishes of the present text. One other important distinction between the Acts of 1823 and 1832 was this: Under the former Act the sums assessed on the parish, making up the composition, were to be paid by the occupiers of the land; under the Act of 1832, the payment was to be made by persons having a greater interest than that of tenant-at-will or tenant from year to year, the liability devolving on the expiration of such first greater estate, on the next greater estate and so on for ever to the fee.[28]

Within this framework, tithe compositions were established. Whether the procedure was by agreement or valuation the commissioners, or commissioner, were to subjoin, in all cases, to their certificates fixing the composition a state-

---

25*cf.*, *Report of the Select Committee, June*, 1832; at p.245—VI; it is also stated that "the general impediment has been the resistance of the principal proprietors and occupiers, whose parks or grasing land, by the operation of the Act, would be subjected to a share of the payment from which they had been exempted since 1735."

26—2 & 3 Wm. IV., c. 119 Sec. I.

27— ,, Sec. III.

28—2 & 3 Wm. IV., c. 119, Sec. XII.

ment specifying the average price of wheat or oats (whichever of these two was considered as the corn principally grown in the county) calculated from the returns advertised in the Dublin Gazette over either of the septennial periods 1814 to 1821 or 1823 to 1830. Tables giving these prices for the respective periods are printed at p. 340; it is desirable, however, that where particular investigations are being made the prices set down in the commissioners' certificates should be referred to.

With this outline of the law's requirements for the country in general its application to the six parishes is the immediate consideration. For three of these there is authoritative evidence of the mode of tithing as it existed some twenty years prior to the first Act of 1823 with a specification of the crops from which the tithe was derived in the year 1813, and an estimate of the entire produce. The available text is the *Statistical Account* of the episcopally united "Parishes of Carrick, Kilmurry and Kilsheelan" published in the year 1816; its author was the Rector, the Revd. Standish Grady. Widely comprehensive in its survey of matters agricultural and social, this concise account of the united parishes sets forth the rates of tithing, as of the year 1813, thus: "The charge for tythe is, for wheat 12/- per Irish acre; oats 8/-; barley 12/-; potatoes 12/-; meadow 8/-; sallows 12/-; orchards *ad valorem* which are always compounded and never taken in kind." The areas in these classifications, and the tithe payable in respect thereof (at the respective rates quoted) are here cited from the Rector's Valuation Book May 1813, as published:

"Acres			£	s.	d."
1009	of wheat	valued at	605	0	0
1021	of oats	,,	407	0	0
57	of barley	,,	34	0	0
2087			1046	0	0
1041	of potatoes	,,	624	0	0
605	of meadow	,,	242	0	0
15	of sallows	,,	10	0	0
15	of orchards	,,	10	0	0
"1677	(sic)		886	0	0"

To this statement, indicating, in the manner of its specification of the facts, the Great and Small tithes[29] of the united parishes, the writer adds this comment: "As this is about a twentieth part of the value of the entire, it may perhaps be taken as worth £38,644." Wholly relevant is this further observation: "In

29—The tithes of a parish were commonly divided into Great and Small tithes—the former consisting of the tithes of corn of all kinds, hay, wood—and the latter of flax, hemp, fruit, herbs, turnips and in some places of potatoes. The rectorial portion, representing the great tithes, usually consisted of two-thirds, and the vicarial, the small tithes, one third. *Erck*, p.58, *Ecclesiastical Register*, Dublin, 1827.

the country the entire of the male inhabitants are employed in agriculture; and in a general way they are in comfortable circumstances. This supposition arises from observing in the parochial valuation book that few are without some tillage, exclusive of their potato gardens."[30]

Wider research may discover equally satisfactory evidence of the mode of tithing for the remaining parishes. Doubtless it was found to be on the same basis, and at similar rates, when the Commissioner appointed by the Lord Lieutenant, Mr. Ebenezer Radford, arrived in the spring of 1834 to begin the fixing of the compositions for the six areas. It is to this gentleman's painstaking and exceptional methods of setting down his survey that we are indebted for the agricultural statistics of each holding. Proceeding according to the basis provided by the Act of 1832—average income and average prices for corn for the seven years preceding the 1st November, 1830—Mr. Radford rapidly provided each parish with the advantages which the fixing of a composition conferred. Only three of Mr. Radford's certificates, a specimen of which is given[31] fixing the compositions, are forthcoming, these being affixed to the relevant Parish Applotment Books, namely Kiltegan, (April 19, 1834), Kilcash (May 12, 1834) and Kilmurry (June 21, 1834). The dates in brackets are those of the certificates fixing the composition. In each instance it is certified that wheat was the corn principally grown in the parish and that the average price, for the period of seven years preceding the 1st November, 1830, was £1 9s. 9d. per barrel of twenty stone The evidence, as to the corn principally grown in the three parishes for which the certificates are missing, is furnished by the Applotment Books; reference to the returns of these will show that wheat was also the principal corn grown in the parishes of Carrick-on-Suir, Kilsheelan and Derrygrath. It is to the Applotment Books also that reference must be made for the evidence on which to base an estimate of the relationship of the Tithe Composition to the valuation of the farms as at the year 1834.

The origin of these books resides in the requirements of the Acts for the assessment of the compositions when fixed on the landholders of the various parishes.

30—Other interesting and relevant facts given in this *Account* may be noted: " In the neighbourhood of towns, rents are in general much higher in proportion to the value of the lands than at a distance. For a mile round Carrick, ground lets at from eight to twelve guineas per acre, in the country it would be difficult to average the rents as the lands vary through every variety from the richest pasture to rocky hills . . . "; as to farms " there are 13 of above 100 acres, 23 of 50 and upwards; on the whole more farms through the district exceed 20 acres than fall short of that number . . . There are several extensive dairies, the number of milk cows on which does not fall short of 200."

31—" I. Ebenezer Radford, Tithe Commissioner, duly appointed and sworn under and by virtue of an Act made in the 2nd and 3rd of King William 4th, . . . providing for the establishing of Compositions for Tithes in Ireland and to make such compositions permanent; to ascertain and fix a true and just composition for all Tithes arising, growing, yielded or payable within the parish of Kilcash in the Co. of Tipperary and Diocese of Lismore. Do hereby certify that the true and just amount of Composition for all Tithes whatever within the said parish of Kilcash as aforesaid is £113 17s. 3½d. per annum—that is to say, the sum of £46 3s. 1d. per annum is due and payable to Lord Ormonde as owner of the Rectorial Tithe of said Parish and the further sum of £67 14s. 2½d. per annum is due and payable to the Revd. Chaworth Browne as Vicar of said Parish. And I do further certify that the average price of wheat being the corn principally grown in said Parish for the period of 7 years preceding the 1st November, 1830, was £1 9s. 9d. per barrel of 20 stone. (Signed) Ebenezer Radford, Tithe Commissioner for such Parish.

The details of such assessment, which was to be made " equally in proportion and according to the true annual value of the several lands " were to be entered in a book signed by the Commissioner ; this book was to be delivered to the owner of the tithe-composition who, in turn, was to make it available for inspection, examination, or copying. Under the following headings the details of the assessments of the six parishes are set down in the signed, though undated, Applotment Books of Mr. Radford—below the textual superior caption " Titheable "—(1) names of diocese, parish, townland and occupier (2) quantities (areas) in detail (3) quality (4) total quantity in holding, (5) total quantity in townland (6) rents paid, per acre (7) real acreable value (8) quantities in townland (9) rectorial portion of tithes (10) Vicarial portion (11) total amount of composition in holding (12) total amount of composition in townland. Where a lay person[32] was the owner of tithes the fact is so stated ; where areas are expressed they are in Irish measure.

The present exigencies of space, no less indeed than clarity itself, demanded that the expansive and repetitive method of the original text should be reduced to a more compact form preserving all the essential features and particulars under the common headings to which they belonged. For example the agricultural classifications now given at the beginning of each parish and every page—potatoes, wheat, oats, barley, pasture, fallow, are set down in the Land Commission text under each holding. The form of the return adopted for the presentation of these particulars eliminates nothing more than the repetitions indicated. For land which could not be included in any of the foregoing classifications it became necessary to provide a special column entitled 'Other Land.' Under this heading are included areas described as orchards, gardens, osiery, woodlands, heathy pasture and plantations—the last two being frequently grouped together in the original text. Two columns in the original text record the " total quantities in holding " and the " total quantities in townland," that is to say the respective total areas. With the exception in one or two instances of minute differences explained by small areas in roads or under water, the totals for both "quantities" agree throughout. It was decided therefore to give, in addition to the detailed areas of each holding, only the totals of such areas these expressing the total areas of " Townlands." The amounts assessed for rectorial, vicarial and lay compositions are distinctively specified in separate columns in the Applotment Books, the total assessment for each holding being shown in the column reserved for the purpose ; it was considered that the requirements of the present text would be met by giving such total assessments for each holding. Under the caption " Quality," the original text describes the areas in wheat, pasture and so on, as either "good," " middling," or " bad." In the absence of a description of the soil, it was decided that there would be little advantage in reproducing such descriptions. Particulars of the " Rents paid " are furnished in respect of three parishes only—Kilcash, Kiltegan and Derrygrath; the column for this information was eliminated, accordingly, in regard to the

---

32—From the granting away by the Crown of the Tithes belonging to Religious Houses sprang those Impropriations so denominated, according to Spelman, " as being improperly in the hands of laymen " ; *The Eccl. Register*, plvi., *Erck.*

remaining parishes. In all other respects there is complete uniformity between the text of the Applotment Books and the present publication.

Of the many items set down in the Applotment Books only one, that comprehended in the term " Real Acreable Value " calls for an explanation here; as its meaning must provide the key to the determination of the relationship of Tithe Composition to the productive capacity of the land, some sources available for determining the problem may be stated.

In the absence of any textual indications as to Mr. Radford's basis of valuing, the meaning of " Real Acreable Value " may be deduced from the instructions in the Act and from the principle of valuation adopted elsewhere in the county, at this time, though by another valuer, for which information is available. As has been seen, the applotment and assessment were to be made " according to the true annual value." But even this direction demands explanation. A definition of " annual value " is given in an Act of Parliament[33] passed a few years subsequent to the date of the Composition proceedings—the Poor Law Act of 1837. According to this Act the " annual value " of lands and premises was the rent at which one year with another they might in their actual state be reasonably expected to let from year to year, repairs and all rates and taxes being paid by the tenant. A comparison, by averages, of the valuation expressed in the Applotment Books, with the Poor Law Valuations gave the following interesting results ; for two parishes they were identical, for two more parishes they were within a shilling of each other, and for the two remaining parishes the Tithe Composition Valuation was greater by about seven and five shillings, respectively. But more even than this explanation is required, namely, the principle of determining the annual value. This is forthcoming to some extent in respect of valuations for assessments of tithe composition in the neighbouring barony of Middlethird and in the western regions of Slieveardagh and Eliogarty. It is contained in statements made before the Select Committee on Tithes, 1832, and was to the effect that " value per acre " meant the rent the land would bring if let by itself ; that it was believed the proportion of rent each tenant paid was less than a third of the entire value ; " that the value was calculated at less than three rents, but not so small a proportion as two ; that on the supposition that the value per acre should be from two-fifths to one-third of the gross produce some seventeen Tipperary parishes were valued for Tithe Composition."[34]

While the meaning of " Real Acreable Value " may be deduced from the foregoing considerations, its technical definition warranted recourse to competent authority : " The expression ' Real Acreable Value ' means the net annual value, in other words, the sum an acre is worth per annum based on the full productive

33—1 & 2 *Vic., cap.* 56—Secs. 63-65.

34—Evidence of Wm. Palmer, Agent and Valuer, at question 2058 *et seq.*—" I think there ought to be three rents out of the land in Ireland, but I do not believe there are three rents, and therefore, I did not calculate it in that proportion ; I calculated it at less than three rents, but not so small a proportion as two—I would calculate it in this way—that a tenant does not make three rents ; he makes more than two, but not three. I conceive that the proportion of rent that each tenant pays, generally, is less than a third of the entire value of the land."

capacity and deducting all outgoings and taking an average over a period of years, say five. The figure thus obtained where a farm was let to a tenant would include both the landlord's and tenant's interest. Prior to the year 1881 before the Land Acts came into operation the landlords and tenants interests were about equal shares, viz. about one-fifth each of the productive capacity, thus the real acreable value would appear to be about two-fifths of the total productive capacity. In other words two-fifths of the total productive capacity equals Net Annual Value."[35]

The amounts of the Compositions fixed for the six parishes, with the respective valuations, are set out in one of the tables printed as an appendix (see p. 339). Such compositions were in the following proportions, approximately, to the total "Real Acreable Value": Carrick-on-Suir one-twentieth, Kilmurry one-twelfth, Kilsheelan one-twelfth, Kilcash one-sixteenth, Kiltegan one twentieth, and Derrygrath one-twentieth. Assuming that the principle on which the "Real Acreable Value" of Mr. Radford's applotment was determined represented two-fifths of the entire "productive capacity," then in the instances where the proportion of composition to "Real Acreable Value" was one-twentieth, the composition represented one-fiftieth of such capacity; where the proportions were one-twelfth the composition was in the proportion of one-thirtieth to the productive capacity.

The landholders of the parishes were assessed to the tithe composition on the basis of the foregoing proportions, that is to say if the total "Real Acreable Value" of a holding was £25, and the proportion of composition to valuation was approximately one-twentieth, the tenant's tithe liability would be £1 5s. or thereabouts. It should be stated, however, that at the period of these Tithe Compositions the view was fairly widely held, derived, according to one witness, from the theories of Adam Smith,[36] that the rent represented a third part of the produce. On this basis, indeed, extensive calculations were made[37] for each province showing the relation of composition to total produce and were submitted to, and printed by, the Select Committee of 1832. The statement of the facts and figures presented for the province of Munster concludes:[38] "On the assumption of the rent being one-third of the produce and it appearing that the average rates of composition vary from an eighteenth to a nineteenth part of the rent of an Irish acre, reduced 25 per cent proportionably to the fall of the price in wheat or 20 per cent proportionably to the fall of price in oats as may be the tithes lay and ecclesiastical, in the south of Ireland average from a fifty-fourth to a fifty-seventh part of the produce."

It will be recalled that the proportion of tithe to produce for the united parishes of Carrick, Kilmurry and Kilsheelan was stated, as of the year 1813, to be one-twentieth. While this proportion is also expressed in the composition valuation of 1834 in regard to the parish of Carrick, the proportion for the parishes of

---

35—On the basis of some figures supplied by the writer, from the Ap. Books, this opinion was kindly given by *Mr. Wm. N. Heron* of the Valuation Office, Dublin, through the courtesy of the Chief Valuer, Mr. F. M. Clarke, F. S. I.

36—See the evidence of Lord Mountcashel before the *Occupation of Land Commission* (1843), q. 20.

37—By John Caillard Erck, pp. 561-624.

38—*Supra*, p. 603.

Kilmurry and Kilsheelan is approximately one-twelfth. By the subjection of pasture land to tithe, it may be explained, these two parishes provided 5,593 statute acres as an added source of income in this connection.

Though the Applotment Books return "rents paid" over three parishes, averages can be calculated only in respect of two—Kiltegan, near Clonmel, and Kilcash, north-west of Carrick; relatively few rents are given for Derrygrath. Satisfactory averages, however, can only be obtained by some such classification for land, in respect of which the rents are recorded, as good, medium, inferior. This task is left to students of the text for whom there is also a wide source of information available in the Court rentals[39] of the decade 1850-1860. For those parishes over which the rents are not returned the valuations will be found a useful guide: the lowest rate of valuation in Carrick-on-Suir, for example, was £1 15s. per Irish acre—the highest £7. Where the rents have been returned it will be observed that for the most part they are above the "real acreable value."

The year 1838 denoted the end of Tithe Compositions, an Act then passed (1 & 2 Vic. c. 109) declaring that "it was expedient to abolish them." In the documents which have survived for the proceedings of 1823-1837, and for that matter of anterior date, there is a vast range of material available for students working on either agricultural or topographical lines.[40] It has always to be borne in mind, however, that in regard to Valuation, the Tithe proceedings, like those of the Poor Law, suffered from want of uniformity in the principles adopted.

The Thurles document is published for the purpose of showing acreable produce and prices in that parochial area for the three years 1828, 1829 and 1830. Internal evidence suggests that this unsigned document was drawn up in connection with the collection of outstanding tithes, the particulars as to acreage and produce being derived, no doubt, from the Valuation Books of the tithe-owner for the years specified; see Note 19, *supra* with regard to the Diocese of Cashel. It is endorsed, in pencil, "Old Tithe Book" and is preserved with documents, in the Land Commission collection, relating to the later proceedings of 1833 for establishing the Tithe Composition of Thurles parish. No doubt it was in connection with such proceedings that this valuable document reached the responsible commissioner. The acreages are in Irish measure, and, where very

---

39—*Incumbered and Landed Estates*—The nature of information to be found here in addition to a specification of rents under leases, anterior in date to these rentals, may be given; the following relates to lands within the parish of Kilsheelan—"The soil part of the celebrated "Golden Vein of Tipperary" and on the junction of the "Limestone gravel", "Clay Slate" and "Red Sand Stone" formations, is naturally rich and fertile . . ."; again— regarding property on the road from Carrick to Clonmel "strong indications of iron ore and other minerals," and such like observations. A not infrequent clause in leases, *circa* 1827, cited in these rentals, is to the following effect: "the lesee to pay during last two years of term over and above acreable rent reserved in lease for every acre of meadow . . . ploughed or converted into tillage the sum of £10."

40—With regard to a history of tithes, the history of agriculture itself is involved here. In addition to Land Commission MS. material for the study of the related matters of tithe and produce *cf.*, also the data recorded in the published Statistical and Parochial Surveys of Ireland, the latter edited by W. Shaw Mason, *circa*, 1816, Dublin .

small, they have been expressed in fractions in the present text; for guidance these fractions have been equalised in a table printed at p. 337. Otherwise the "Old Tithe Book" as printed agrees with the original document.

The holdings are of small extent ranging from three-eighths of an acre to ten acres, the produce of the farms varying considerably. Some samples of production per acre and prices may be given here: wheat 4 to 8 barrels, price 25/- a barrel; potatoes 50 and again 60 barrels at 3/- and 5/- per barrel; oats 9, 10 and 12 barrels, 10/- and 10/6 a barrel; barley 12 and 12½ barrels, 8d. and 10d. per stone; meadow 2 and 3 tons at 2/- per cwt. As indicated by the text the tithes represented, in each instance, one-tenth part of the produce.

This document, it is hoped, will prove useful in determining what an Irish acre of land (for the years specified) was capable of producing; with a basis for average prices there is useful data for, at least, a discussion of the question of "Real Acreable Value."

In conclusion, it may be said that the examination of the extensive collection of Tithe MSS. has been limited to particular areas; further research may bring to light even earlier documents bearing on the history of agricultural production and prices. It is desirable, certainly, that special search should be made for further applotments of Mr. Ebenezer Radford.

AGRICULTURAL RETURNS, A.D.1834

WITH TITHE COMPOSITION APPLOTMENT AND VALUATION

COUNTY OF TIPPERARY

PARISHES OF:

COUNTY OF TIPPERARY

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834
(2 & 3 Wm. IV. c. 119—Applotment Book No. 29).

PARISH OF CARRICK-ON-SUIR—DIOCESE OF LISMORE

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value†			Amount of Composition for Tithe†		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
BALLYLINCH (Ballylynch)														
Michl. & J. Higgins *	3½	5	½	—	38	—	—	47	1	15	0	4	2	4½
Michl. Ryan	—	—	1	—	9½	—	1½ (Hosiary)*	12	2	0	0	1	4	11
Reps. Sir Thos. Osborne (decd.)	2	½	—	—	20	—	3 (Orchard)	25½	3	0	0	4	0	6½
Richd. Wilson	—	1	1¼	—	2	—	¾ (Garden)	5	5	0	0	1	4	9
John Maher	¼	¼	—	—	—	—	—	½	4	0	0	0	2	2
Timy Flanigan	—	—	1	—	—	—	—	1	4	0	0	0	4	2¼
Martin Ryan	—	½	—	—	—	—	—	½	4	0	0	0	2	2
Willm. Dwyer	¼	—	¼	—	—	—	—	½	4	0	0	0	2	2
Thos. Prendergast	½	—	—	—	—	—	—	½	4	0	0	0	2	2
Thos. Dillon	½	½	—	—	—	—	—	1	4	0	0	0	4	3

* Osiery. † English Currency.

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
BALLYLINCH—*Condt.*														
John Dalton . .	1	1	—	—	—	—	—	2	4	0	0	0	8	3
Lawce. Hickey . .	—	½	—	—	—	—	—	½	4	0	0	0	2	2
John Lahey	1	—	—	—	—	—	—	1	4	0	0	0	4	2¼
Michl. Higgins	2¼	—	—	—	4¾	—	—	7	4	0	0	1	8	4½
Edmd. Shea	2	1¼	1½	—	1¼	—	—	6	3	0	0	0	19	1
Jefy. Prendergast ..	5	4½	—	—	5½	—	—	15	3	0	0	2	7	6
Richd. Prendergast	4½	—	2¾	—	6¾	—	—	14	3	0	0	2	4	3½
Danl. Halliday	—	—	—	—	—	—	3 (Hosiary)	3	2	0	0	0	6	4½
Jno. Weeks	½	—	½	—	—	—	—	1	4	0	0	0	4	2½
Wm. H. Bradshaw Esqre.	—	—	—	—	10	—	1 (Garden)	11	4	0	0	2	4	6
Patk. English	—	—	4½	—	—	—	—	4½	4	0	0	0	18	3½
Wm. Milward, Esqre	¾	—	—	—	—	—	—	¾	4	0	0	0	3	1
Jno. Corbett	2	—	—	—	2½	—	¼ (Garden, etc.)	4¾	5	0	0	1	3	4½
Henry Briscoe, Esqre	1	—	½	—	—	—	—	1½	4	0	0	0	6	1½
Total for Holdings in Townland	*27*	*15*	*13¾*	—	*100¼*	—	*9¼*	*165½*				*24*	*9*	*6½*

PARISH OF CARRICK-ON-SUIR—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
TINVAWN (Tinvane)										
Henry Briscoe. Esqre	4	3¾	2	—	29¾	—	4½ (Garden, Orchard etc.)	44	3 0 0	6 18 11½
Thos. Dooley	2	2½	—	—	3½	—	—	8	4 0 0	1 12 4
Mary Lahey	1½	2	—	—	15	—	—	18½	4 0 0	3 14 7½
Michl. Tobin Senr.	—	1½	1½	—	—	—	—	3	3 0 0	0 9 6
Total for Holdings in Townland	*7½*	*9¾*	*3½*	—	*48¼*	—	*4½*	*73½*		*12 15 5*
ASH PARK										
Robt. Quinlan	—	1¼	—	—	—	—	—	1¼	4 0 0	5 1½
Richd. Dunphy	—	½		—	—	—	—	½	4 0 0	2 1
John Larkin	¾	¾	—	—	—	—	—	1½	4 0 0	6 1½
Walr. Shea	½	—	—	—	—	—	—	½	4 0 0	2 1
John O'Neill	2	—		—	2½	—	¾ (Garden, etc.)	5¼	5 0 0	1 5 10
Henry Briscoe, Esqre.	—	—		—	—	—	¾ Hospital Garden, etc.)	¾	5 0 0	3 8½
Lord Ormonde (Tenants not known)	—	—	—	—	—	—	1½ under cabbage several lots.	1½	5 0 0	7 4½

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
ASH PARK—(*Contd.*)														
Mr. Ryan Car Office	—	—	—	—	—	—	15 (Hosiary)	15	3	0	0	2	7	4½
Total for Holdings in Townland	3¼	2½	—	—	2½	—	*18*	*26¼*				*4*	*19*	*8½*
CARRICK TOWN														
Attached to Nunnry	—	—	—	—	—	—	¾ (Garden, etc.)	¾	5	0	0		3	8½
Cooney/Smith/Jas. Egan and others	½	—	—	—	—	—	—	½	4	0	0		2	1
Mrs. Markham and Mr. Moore	1¼	—	—	—	—	—	—	1¼	4	0	0		5	1
Jas. Feenussy	—	—	—	—	—	—	¼ (Vegetable Garden)	¼	4	0	0		1	1
Walter Herbert, Esqre	—	—	—	—	—	—	¾ (Garden, etc.)	¾	5	0	0		3	8½
Josh. O'Donnell	—	—	—	—	—	—	¼ (Garden, etc.)	¼	4	0	0		1	1
Mr. Halliday ...	—	—	—	—	—	—	¼ (Garden, etc.)	¼	4	0	0		1	1
Edwd. Maher ...	—	—	—	—	—	—	¼ (Garden, etc.)	¼	4	0	0		1	1
Mauce. O'Donnell, Esqre.	—	—	—	—	—	—	¼ (Garden, etc.)	¼	4	0	0		1	1

PARISH OF CARRICK-ON-SUIR—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value	Amount of Composition for Tithe
CARRICK TOWN— (*Contd.*)									£ s. d.	£ s. d.
Patk. Darmody	—	—	—	—	—	—	¼ (Garden, etc.)	¼	4 0 0	1 1
Mr. Ryan Car Office	—	—	—	—	—	—	¼ (Plot of Ground)	¼	4 0 0	1 1
Val. O'Donnell, Esqre.	—	—	—	—	—	—	½ (Garden, etc.)	½	5 0 0	2 6
Total for Holdings in Townland	*1¾*	—	—	—	—	—	*3¾*	*5½*		*1 4 8*
BALLYRICHARD										
John Power, Esqre.	2½	6	2	1	28	—	½ (Garden)	40	3 0 0	6 6 4
—— Heffernan	1½	—	—	—	—	—	—	1½	4 0 0	6 1
—— Fitzpatrick	—	2½	-	—	—	—	—	2½	4 0 0	10 1
James Hyland	1¼	—	—	¾	2	—	—	4	4 0 0	16 1½
Mauce. O'Donnell	5	—	2¼	½	¾	—	1¼ (Garden, etc.)	9¾	5 0 0	2 7 6
Maunsell Bowers	3	—	—	—	—	—	—	3	4 0 0	12 0
Thos. Wilson, Esqre.	½	—	1	—	—	—	—	1½	4 0 0	6 0
John Lawless, Esqre.	2	2	1¼	—	—	—	—	5¼	4 0 0	1 1 1½

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £	s.	d.	Amount of Composition for Tithe £	s.	d.
BALLYRICHARD— (*Contd.*)														
Henry Briscoe, Esqre.	2	2¼	—	—	—	—	—	4¼	4	0	0		17	1½
John Power/Carrick Beg/	2	—	—	—	—	—	—	2	4	0	0		8	0
Patk. Hayden/ Carrick Beg/	3½	—	¾	—	—	—	—	4¼	4	0	0		17	1½
Edd. Fleming	—	—	—	—	3¾	—	—	3¾	4	0	0		15	0
Thos. Gallevan ..	2½	2	—	—	—	—	—	4½	4	0	0		18	1½
Richd. Sause Esqre.	2¼	1½	—	—	—	—	—	3¾	4	0	0		15	0
Jas. Cooney ...	2	1	—	—	8	—	—	11	3	0	0	1	14	7½
Widow Quirk	¼	—	½	—	¼	—	—	1	3	0	0		3	1½
Michl. Nugent	2½	4½	—	—	21	—	—	28	3	0	0	4	8	4½
Patk. Deehy	3	1½	4	—	2	—	½ (Garden, etc.)	11	3	0	0	1	14	7½
Total for Holdings in Townland	*35¾*	*23¼*	*11¾*	*2¼*	*65¾*	—	*2¼*	*141*				*24*	*16*	*4½*
CREGG ROAD.														
Patk. Daniel	2½	—	1½	3	8½	—	—	15½	4	0	0	3	0	11
Total for Holdings in Townland	*2½*	—	*1½*	*3*	*8½*	—	—	*15½*	*4*	*0*	*0*	*3*	*0*	*11*

PARISH OF CARRICK-ON-SUIR—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
GREEN HILLS.														
Willm. Power	1	—	—	—	—	—	—	1	4	0	0		4	0
Patk. Quirk	—	2	—	—	1¾	—		3¾	4	0	0		15	0
Thos. Walshe	—	—	—	—	—	—	1½ (Orchard, Nursery, etc.)	1½	5	0	0		7	3
—— Shea	1	—	—	—	—	—	—	1	4	0	0		4	0
John Walshe	½	—	—	—	—	—	—	½	4	0	0		2	0
Michl. Hyland	—	—	—	1	—	—	—	1	4	0	0		4	0
Willm. O'Donnell	—	—	2½	—	—	—	—	2½	4	0	0		10	0
Edd. Shea	½	1½	—	1½	4	—	—	7½	2	0	0		15	4½
Thos. & Michl. Ryan	1	1	—	—	—	—	—	2	2	10	0		5	7½
John Coffey	—	—	—	—	7¼	—	—	7¼	3	0	0	1	2	10½
Richd. Branigan	—	1½	—	—	6½	—	—	8	3	0	0	1	5	3
Walter Shea	1½	1	—	—	1½	—	—	4	4	0	0		16	1½
Willm. Tobin	1	—	1¾	—	—	—	—	2¾	4	0	0		11	0
Thomas Sutley	—	—	¾	—	—	—	—	¾	4	0	0		3	0

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
GREEN HILLS—*Contd*														
Patk. Hartney	—	—	¾	—	—	—	—	¾	4	0	0		3	0
Total for Holdings in Townland	*6½*	*7*	*5¾*	*2½*	*21*	—	*1½*	*44¼*				*7*	*8*	*6*
PILL HOUSE.														
John S. Wells	—	5	—	—	1	—	1 (Tanyard, Garden, etc.)	7	5	0	0	1	14	3
Total for Holdings in Townland ...	—	*5*	—	—	*1*	—	*1*	*7*	*5*	*0*	*0*	*1*	*14*	*3*
BALLINAGRANA (Ballynagrana)														
James Walshe ...	1¾	2½	1¼	—	9½	—	—	15	3	0	0	2	7	4½
Widow of Jno. Walshe	1	—	—	—	—	—	—	1	4	0	0		4	0
Henry Mathews	1	—	—	—	—	—	—	1	4	0	0		4	0
Edmd. Read	—	—	—	—	—	—	1½ (Garden, Orchard, etc.)	1½	5	0	0		7	3
Widow Wall	—	—	—	—	1	—	—	1	4	0	0		4	0
Richd. Read ..	—	—	—	—	—	—	1½ (Garden, Orchard, etc.)	1½	5	0	0		7	3

PARISH OF CARRICK-ON-SUIR—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
BALLINAGRANA —*Contd.*														
James Brien	1¼	2¼	—	—	4	—	—	7½	4	0	0	1	10	1½
John Hayden	1	1	—	—	1	—	—	3	4	0	0		12	0
Michl. Meney	1½	—	—	—	—	—	—	1½	4	0	0		6	0
Widow Wall/Thomas/	3¼	3	¾	—	4	—	—	11	4	0	0	2	4	3
Total for Holdings in Townland	*10¾*	*8¾*	*2*	—	*19½*	—	*3*	*44*				*8*	*6*	*3*
KNOCKNACONRY (Knocknaconnery)														
John Halloran	—	—	—	—	5½	—	—	5½	4	0	0	1	2	1½
Winny Brophy/ Widow/	—	—	—	—	1¾	—	—	1¾	4	0	0		7	0
Thomas Prendergast	½	1	—	½	—	—	—	2	4	0	0		8	0
Martin Fitzpatrick	¾	¾	—	½	—	—	—	2	4	0	0		8	0
Edwd. Briscoe Esqre.	—	—	¾	—	—	—	¼ (Garden, etc.)	1	4	0	0		4	0
John Rorke	1¼	1¼	—	—	¾	—	—	3¼	4	0	0		13	0

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
KNOCKNACONRY—*Contd.*														
Willm. Power	6	5	¾	1¼	2	—	—	15	4	0	0	3	0	6
Thos. Hogan	1½	—	2½	—	4½	—	—	8½	2	10	0	1	3	10
John Dunphy	2	1	—	1½	—	—	—	4½	4	0	0		18	1½
Total for Holdings in Townland	*12*	*9*	*1*	*3¾*	*14½*	—	¼	*43½*				*8*	*4*	*7*
SHAWVILLE.														
Patk. Comerford	6	6¾	2½	—	11¾	1½	—	28½	3	0	0	4	9	10½
Darbey Rourke	—	—	—	—	6	—	—	6	3	0	0		18	10½
Peter Walshe, Esqre.	1½	½	1¼	—	13¾	—	½ (Garden)	17½	5	0	0	4	5	10½
Total for Holdings in Townland ...	7½	*7¼*	*3¾*	—	*31½*	*1½*	½	*52*				*9*	*14*	*7½*
SIR JOHNS ROAD														
Mrs. Mandeville ...	3¼	3	1	—	22½	—	1½ (Orchard) 2 (Garden etc)	33¼	5	0	0	8	5	6½
Lory Jephson, Esqre.	—	—	—	—	1	—	1 (Garden, etc.)	2	6	0	0		11	6½

PARISH OF CARRICK-ON-SUIR—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £ s. d.	Amount of Composition for Tithe £ s. d.
SIR JOHNS ROAD —*Contd.*										
Walter Herbert, Esqre.	2¼	—	—	—	7½	—	—	9¾	5 0 0	2 7 10
Patk. Dalton	¼	—	—	—	½	—	½ (Garden, etc.)	1¼	5 0 0	6 1⅓
Willm. Lyons	—	—	—	—	—	—	½ (Orchard)	½	6 0 0	2 10⅓
Total for Holdings in Townland	*6¼*	*3*	*1*	—	*31½*	—	*5½*	*47¼*		*11 13 11*
LODGE GROUND										
Mrs. Vass /Carrick	3	1¾	—	—	—	—	—	4¾	4 0 0	19 1⅓
Mrs. Wall/Carrick	1¾	1¼	—	—	1½	—	—	4½	4 0 0	18 1½
Willm. O'Donnell, Esqre.	1½ Potatoes Garden etc.	—	—	—	18½	—	—	20	5 0 0	4 18 2
Leonard Egan	2½	1¼	—	—	1¼	—	—	5	4 0 0	1 0 2
Widow Wall Thos.	½	½	—	—	—	—	—	1	4 0 0	4 0
Patk. Dwyer	—	¾	—	—	—	—	—	¾	4 0 0	3 0
Edd. Quinlan	—	—	—	—	¾	—	—	¾	4 0 0	3 0
Patk. Stephenson	—	—	—	—	¾	—	—	¾	5 0 0	3 8
Total for Holdings in Townland	*9¼*	*5½*	—	—	*22¾*	—	—	*37½*		*8 9 3*

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
DEER PARK.														
Willm. O'Donnell, Esqre.	7½	8½	—	—	40	—	2 (Orchard & Garden)	58	2	10	0	8	3	1½
John Foran	3	2	½	—	14½	—	—	20	2	10	0	2	16	3
Patk. Kelly	3½	2	2	—	8½	—	—	16	3	0	0	2	10	6
Chas. Fennessy ...	3½	—	2	—	4½	—	—	10	4	0	0	2	0	3½
Pierce Walshe	3½	3½	2½	—	—	—	—	9½	4	0	0	1	18	3
Mrs. Ryan/Widow/	1¼	2	1½	—	4¾	—	—	9½	4	0	0	1	18	3
Pierce Davin ...	4½	2¼	4	—	—	—	½ (Orchard	11¼	4	0	0	2	5	4½
Richd. Reddy ...	5½	5	1½	—	1½	—	1½ (Orchard)	15	3	0	0	2	7	4
Edd. Foran	3	4½	2½	—	5	—	—	15	3	0	0	2	7	4
Kearney & Hickey	9	6¼	7	—	15¾	—	—	38	2	0	0	3	18	4½
Widow Heckey & Daniell	6	5	7¼	—	¾	—	—	19	2	10	0	2	13	5
Michl. Hickey ...	3½	4½	4	—	3¼	½	—	15¾	2	10	0	2	4	3
Bridget Drohan	1	2	—	—	—	—	—	3	2	10	0		8	5
John Ruddy or Reddy	6½	3½	3½	—	6	½	—	20	2	0	0	2	1	3

PARISH OF CARRICK-ON-SUIR—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
DEER PARK—*Contd.*														
Edmd. Rockett	12	7	5½	—	19½	—	1 (Orchard & Haggard)	45	2	0	0	4	12	9½
Willm. Rockett	4¾	6	2½	—	6¾	—	—	20	2	0	0	1	19	8½
John & Patk. Arrigan	12	6	5	—	37	—	—	60	2	0	0	6	3	9
Patk. Deady	—	—	—	—	3¾	—	—	3¾	2	10	0		10	3
Total for Holdings in Townland	*90*	*70*	*51¼*	—	*171½*	*1*	*5*	*388¾*	*2*	*10*	*0*	*50*	*18*	*11*
BALLINDERRY.														
Pierce & Widow Quinlan	13	8	9	—	42	—	—	72	2	0	0	7	8	6
Chas. Keeffe	4	3½	2½	—	—	—	—	10	2	0	0	1	0	7½
Patk. Drohan	5	4	1	—	—	—	—	10	2	0	0	1	0	7½
Michl. Foley	10	7	—	—	2½	—	—	19½	2	10	0	2	0	3
Patk. Brenan	—	1	—	—	—	—	—	1	3	0	0		3	1½
Adam Powers	6¾	7	5	—	19¼	—	—	38	2	0	0	3	18	5
Mary Foran/Widow/	1½	2¼	—	—	½	—	—	4¼	2	0	0		8	6
Total for Holdings in Townland	*40¼*	*32¾*	*17½*	—	*64¼*	—	—	*154¾*				*16*	*0*	*0½*

PARISH OF CARRICK-ON-SUIR

RECAPITULATION.

(Acres—Irish Measure.)

Townland	Potatoes	Wheat	Oats	Barley	Pastur	Fallow	Other Land	TOTAL
Ballylinch	27	15	13¾	—	100¼	—	9½	165½
Tinvawn	7½	9¾	3½	—	48¼	—	4½	73½
Ash Park	3¼	2¼	—	—	2½	—	18	26¼
Carrick Town	1¾	—	—	—	—	—	3¾	5½
Ballyrichard	35¾	23¼	11¾	2¼	65¾	—	2¼	141
Cregg Road ...	2½	—	1½	3	8½	—	—	15½
Green Hills . .	6½	7	5¾	2½	21	—	1½	44¼
Pill House	—	5	—	—	1	—	1	7
Ballinagrana ...	10¾	8¾	2	—	19½	—	3	44
Knocknaconry ...	12	9	4	3¾	14½	—	¼	43½
Shawville	7½	7¼	3¾	—	31½	1½	½	52
Sir John's Road	6¼	3	1	—	31½	—	5½	47¼
Lodge Ground	9¼	5½	—	—	22¾	—	—	37½
Deer Park	90	70	51¼	—	171½	1	5	388¾
Ballinderry ...	40¼	32¾	17½	—	64¼	—	—	154¾
Total for Parish .... (Irish Measure)	260¼	198¾	115¾	11½	602¾	2½	54¾	1246¼
Statute Measure ...	421	321	187	19	977	4	89	2018

COUNTY OF TIPPERARY

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834

(2 & 3 Wm. IV. c. 119—Applotment Book No. 29).

PARISH OF KILMURRY—DIOCESE OF LISMORE.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
BALLYNORAN										
Thos. & Jas. Arrigan	24¼	19	5	—	47½	—	5 (Orchards)	101	2 0 0	16 18 9½
Michl. Keeffe ...	1	¾	—	—	—	—	—	1¾	2 0 0	5 10½
Willm. Doyle .	2¼	1½	3¼	—	—	—	—	7	2 0 0	1 3 6
Thos. Arrigan /again/	—	—	—	—	—	4	—	4	2 0 0	13 5
John & Willm. Bryan	7	10½	4½	—	8	—	—	30	2 0 0	5 0 8
John Duggan	½	—	½	—	—	—	—	1	1 15 0	2 11
Willm. O'Donnell, Esqre.	15½	14	8	—	67½	—	—	105	2 0 0	17 12 1
David Keefe	6	18	6	—	9½	2½	—	42	1 15 0	6 3 5
Richd. Light or Lloyd	3	3	1½	—	3½	—	2 (Orchard)	13	1 10 0	1 12 9
Margt. Harney /Widow/	7½	9½	3	—	6	—	—	26	1 10 0	3 5 7
Willm. O'Donnell, Esqre. /again/	1	2	—	—	—	—	—	3	1 15 0	8 10

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT, OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s	d.
BALLYNORAN *—Contd.*														
Patk. Baldwin ..	6	9	—	—	4	—	—	19	1	15	0	2	15	10
Mathw. & Mrs. Macnamara	4	—	4	—	—	—	—	8	1	10	0	1	0	2
John Foley	9½	4½	—	—	10¾	—	—	24¾	1	15	0	3	12	9
Total for Holdings in Townland .	*87¾*	*91¾*	*35¾*	—	*156¾*	*6½*	*7*	*385½*				*60*	*16*	*7*
MULLOUGH														
Timy. & Philp. Corbett	10	10½	6	—	18½	—	—	45	2	0	0	7	10	11
Miss Ellen O'Ryan	19½	9	2	—	27¾	—	1¾ (Garden, Orchard, etc)	60	2	0	0	10	1	3
James Phelan .	1¼	2½	1½	—	1½	—	—	6¾	2	0	0	1	2	8
Patk. Wall	2½	1½	—	—	1	—	—	5	2	0	0		16	9
Patk. Deady	10¼	8¾	3½	—	16½	3	5 (Orchard, etc.)	47	1	10	0	5	18	6
Darbey Rourke or Bourke	5	9½	1¼	—	10½	—	¾ (Orchard, etc.)	27	2	0	0	4	10	7
Miss Ellen O'Ryan/ again/	13	1½	5	—	—	—	—	19¼	1	15	0	2	17	3
Mrs. Keily/Widow	10¼	12	3	—	17½	—	—	43	1	15	0	6	6	4
Total for Holdings in Townland .	*72*	*55¼*	*22¼*	—	*93¼*	*3*	*7½*	*253¼*				*39*	*4*	*3*

PARISH OF KILMURRY—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
FIGLASH.														
Richd. Walshe / Proctor	—	—	—	—	17	—	—	17	1	0	0	1	9	0½
Thomas Mulcahy ..	3	1½	—	—	1½	—	—	6	1	10	0		15	2
John Arrigan	3	5½	—	—	—	—	—	8½	1	10	0	1	1	5
John Keresey ...	18½	21½	7	—	18	—	4 (Orchard)	69	1	15	0	10	2	8
Willm. Cleary & Son.	6½	4½	3	—	98	—	—	112	1	5	0	11	15	8
Michl. Clancey	3½	3¾	—	—	1½	—	—	8¾	2	0	0	1	9	4
James Kennedy	4	2½	—	—	3¾	—	—	10¼	1	10	0	1	5	11
Michl. Harney	4	3½	3½	—	9½	—	—	20½	1	15	0	3	0	3
Thomas Power	8	4	—	—	16½	—	—	28½	1	15	0	4	3	9
James Kearnes	5	3	2	—	10¼	—	—	20¼	1	10	0	2	11	1
Edmd. Kennedy	6½	6½	2½	—	22	—	—	37½	1	10	0	4	14	6
Martin Rockett	3¼	5¼	1¾	—	2¼	—	—	12½	1	10	0	1	11	6
Thomas Nugent	½	—	—	—	21½	—	—	22	1	5	0	2	6	4
Patk. FitzGerald	2	2	—	—	—	—	—	4	1	15	0		11	9
Richd. FitzGerald & J. Arrigan	8½	9	3	—	7	—	—	27½	1	10	0	3	9	4

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT, OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £	s.	d.	Amount of Composition for Tithe £	s.	d.
FIGLASH—*Contd.*														
Richd. Carberry	2½	8	2	—	3¼	—	—	15¾	1	5	0	1	13	2
Brian Bowe	5½	—	3	—	4¼	—	—	12¾	1	10	0	1	12	2
Total for Holdings in Townland	*84¼*	*80½*	*27¾*	—	*236¼*	—	*4*	*432¾*				*53*	*13*	*0½*
MACREARY.														
Adam Shea	11	3½	3½	—	40	—	—	58	1	10	0	7	6	3
Patk. or Jn. Hyland	12	10	—	—	50	—	7 (Orchard)	79	1	15	0	11	12	1
Philp. Corbett & & Brothers	10½	8½	8	—	6	1	—	34	1	0	0	2	18	
Luke Doyle	4½	2	2	—	7½	—	—	16	1	10	0	2	0	4
Patk. or Richd. Sexton	—	2	2½	—	13	—	½ (Garden, etc)	18	1	15	0	2	12	11
Michl. Hickey & Fling	9	2¼	2¼	—	5½	—	—	19½	1	5	0	2	1	0
Patk. Brien	5	2	—	—	1	—	—	8	1	0	0		13	8
Thos. & Jno. Walsh/ Smith/	3½	3½	1½	—	15	—	—	23		15	0	1	9	3
Willm. Butters	8	6	4	—	29	—	—	47	1	0	0	4	0	3½

PARISH OF KILMURRY—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
MACREARY—*Contd.*														
John Daniell	7	6	5	—	20	—	—	38	1	0	0	3	4	11
Edmd. Ready	6	7	4	—	24	—	—	41	1	0	0	3	10	0½
Chas. Wm. Wall, Esqe.	—	—	—	—	—	—	54 (Pasture, Heathy and Plantation).	54		5	0	1	10	10½
Donan & Kelly	1½	—	1½	—	3	—	—	6		10	0		5	1½
Connolly & Partners	2	—	2	—	4	—	—	8		15	0		9	4½
Wm. Dunphy & J. Kelly & Partners	7	—	8	—	13½	—	—	28½		10	0	1	5	4
Total for Holdings in Townland	*86¾*	*52½*	*11¼*	—	*231½*	*1*	*61½*	*478*				*44*	*19*	*6½*
BALLYNEAL.														
Patk. Hyland	10	6½	6	—	35½	—	5 (Orchard, etc.)	63	1	10	0	7	18	10
Thomas Keily	13½	12½	—	—	25	4	—	55	1	5	0	5	15	9
Richd. Daniel Senr.	5	8½	5	—	3¼	—	—	21¾	1	10	0	2	14	10
Patk. Hackett	½	½	—	—	1½	—	—	2½	1	10	0		6	4
John Sinnott	3½	3	—	—	—	—	—	6½	1	5	0		13	8

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
BALLYNEAL—*Contd.*										
Jas. Richd. & Nancy Quin	23	22	5	—	10	—	—	60	1 15 0	8 16 3
James Tobin ..	6½	7	5	—	2	—	—	20½	1 10 0	2 11 8
Daniel Ryan ..	1½	—	½	—	—	—	—	2	1 10 0	5 1
Richd. & Nancy Quin /again/	2	8½	—	—	5½	—	—	16	1 10 0	2 0 4
Willm. Cotton & Brother	13¼	15½	·3¼	—	3½	—	—	35½	1 10 0	4 9 6
John Harney & Quin	10½	6½	4½	—	3½	—	—	25	1 10 0	3 3 0
Mary Harney /Widow	2	1½	—	—	—	—	—	3½	1 10 0	8 10
Richd. Daniell ...	5½	5½	—	—	1½	—	—	12½	1 10 0	1 11 6
Denis Daniell	5¼	4¾	½	—	4¼	—	—	14¾	1 5 0	1 11 0
Thomas O'Donnell	15	20	3	—	42	—	—	80	1 10 0	10 1 8
Thos. Daniell	1	—	4	—	1½	—	—	6½	1 5 0	13 8
Thos. & Michl Kennedy	12½	9	5½	—	5	—	—	32	1 10 0	4 0 8
Widow Quin	—	4	—	—	—	—	—	4	1 10 0	10 1
James Quin	—	—	—	—	4	—	—	—	1 10 0	10 1

PARISH OF KILMURRY—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £	s.	d.	Amount of Composition for Tithe £	s.	d.
BALLYNEAL—*Contd.*														
John Murphy	5	—	2	—	1	—	—	8	1	10	0	1	0	2
Total for Holdings in Townland	*135½*	*135½*	*44½*	—	*119*	*4*	*5*	*473*				*59*	*2*	*11*
BALLYCURKEEN														
Mr. John O Ryan	25½	22	27	—	132½	—	3 (Orchard. etc.)	210	1	10	0	26	9	5
Total for Holdings in Townland	*25½*	*22*	*27*	—	*132½*	—	*3*	*210*				*26*	*9*	*5*
LISADOBBIN. (Lisadober).														
Mary P. O Ryan Widow	24	33		—	17	1½	—	75½	1	5	0	7	18	10
Willm. or Jas. Cleary	8	13½	-	—	20½	—	—	42	1	5	0	4	8	5
John Butters	12	13½	—	—	—	—	½ (Garden, Haggart, etc.)	26	1	10	0	3	5	7
Michl. Hahesey	½	2	1½	—	—	—	—	4	1	10	0		10	1
Jno. Macnamara & Jas. Brenan.	12	18	6½		8	—	—	44½	1	10	0	5	12	2
Michl. Mara	5	5½	-	—	—	—	—	10½	1	15	0	1	10	10

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT, OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
LISADOBBIN—*Contd.*														
Tenants name not known, Mr. Scully, landlord.	½	3½	—	—	—	—	—	4	1	10	0		10	1
Mary P. O Ryan/ Widow again/	4	3	—	—	8	—	—	15	1	15	0	2	4	1
Total for Holdings in Townland ...	*66*	*92*	*8*	—	*53½*	*1½*	½	*221½*				*26*	*0*	*1*
BALLINAMONA. (Ballynamona)														
Thos. Macnamara & Shea	19	24	12	—	20	—	—	75	1	15	0	11	0	4
Revd. Patk. Morrissey	10½	5½	5	—	21½	—	½ (Garden, etc)	43	1	15	0	6	6	4
John or James Carbury	—	1	—	—	—	—	—	1	1	10	0		2	6
John Murphy/Proctor/	2	4½	—	—	3½	—	—	10	1	10	0	1	5	3
Edmd. Browne	½	1	½	—	—	—	—	2	1	10	0		5	1
Alley Carroll ..	1½	1¼	—	—	¼	—	—	3	1	10	0		7	7
Robert Quinlan ...	4½	6	12½	—	—	—	—	23	1	15	0	3	7	7
Patk. Brenan	11	11	—	—	8	—	—	30	1	5	0	3	3	2

PARISH OF KILMURRY—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
BALLINAMONA—*Continued.*										
Robert Quinlan /again/ P. Barker, Esqre. Landlord.	3	4	—	—	15	—	—	22	1 10 0	2 15 8
Edmd. Shea	—	—	4	—	2	—	—	6	1 10 0	15 1
— Kennedy	5	7½	—	—	3½	—	—	16	1 15 0	2 7 0
Patk. Fanning	5	1½	—	—	1	—	—	7½	1 15 0	1 2 1
Pony. Barker, Esqre., *Landlord* as I could not learn the tenants name.	3½	—	1	—	1	—	—	5½	1 10 0	13 10
Edmd. Shea	1	—	1½	—	—	—	—	2½	1 5 0	5 3
Edmd. Hahesey	½	—	1	—	—	—	—	1½	1 10 0	3 9
Quin & Hahesey	7	6	2¼	—	3½	—	—	18¾	1 10 0	2 7 3
Willm. Cleary	4	—	2½	—	—	—	—	6½	1 15 0	19 2
Edmd. Hahesey	6½	2½	3	—	3	—	—	15	1 10 0	1 17 10
James Brenan	14½	13½	1½	—	4½	—	—	34	1 15 0	4 19 11
Richd. Forristal & Partners.	22	12	12	—	17	—	—	63	1 5 0	6 12 7
Total for Holdings in Townland	*121*	*101¼*	*58¾*	—	*103¾*	—	½	*385¼*		*50 17 3*

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT, OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
GURTNALUA.														
Robert Quinlan	20	12½	13½	—	30	—	—	76	1	15	0	11	3	3
Total for Holdings in Townland	*20*	*12½*	*13½*	—	*30*	—	—	*76*				*11*	*3*	*3*
BALLYDINE.									£	s.	d.	£	s.	d.
James Power, Esqre.	7	—	—	—	56	—	1 (Garden, etc)	64	2	0	0	10	14	8
Michl. & Jas. Hynes & J. Hennessey	5¾	4½	—	—	¼	—	—	10½	1	10	0	1	6	6
Total for Holdings in Townland	*12¾*	*4½*	—	—	*56¼*	—	*1*	—				*12*	*1*	*2*
BUTLERSTOWN														
Thos. Keating	11½	14	—	—	4½	—	—	30	1	10	0	3	15	8
Madden & two Murrays	2½	5	—	—	½	—	—	8	1	10	0	1	0	2
John Walshe	3½	—	8	—	2½	—	—	14	1	10	0	1	15	3
David Keefe	7¼	—	3¾	—	3	—	—	14	1	5	0	1	9	6
James Meney Senr.	4¼	1¾	—	—	—	—	—	6	1	5	0		12	8
James Meney Junr.	1	1	—	—	—	—	—	2	1	5	0		4	3

PARISH OF KILMURRY—COUNTY OF TIPPERARY.

Townland and Occupiers	Acres—Irish Measure: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £	s.	d.	Amount of Composition for Tithe £	s.	d.
BUTLERSTOWN —*Contd.*														
Edmd. Madden	5	6	—	—	1½	—	—	12½	1	0	0	1	1	4
Robin Jackson . .	¼	¾	—	—	—	—	—	1	1	0	0		1	8½
Edmd. Weafer	2½	3	—	—	½	—	—	6	1	0	0		10	3
Mary Rockett & Son	10	14¼	—	—	25¾	—	—	50	1	10	0	6	[illegible]	1
Denis Hickey .	5	6	2	—	5	—	—	18	1	5	0	1	17	11
John Tobin & Sister	19½	15	9	—	12½	—	—	56	1	5	0	5	17	10
Michl. Connors	6	2	—	—	—	—	—	8	1	10	0	1	9	2
Mathw. Landy .	6	—	—	—	—	—	—	6	1	5	0		12	8
Patk. Landy .	—	1½	1¼	—	15	—	—	18	1	10	0	2	5	5
Patk. Lonergan ..	—	8	—	—	1	—	—	9	1	0	0		15	4½
John Casey	10	7	—	—	—	—	—	17	1	0	0	1	9	0½
Total for Holdings in Townland	*94¼*	*85¼*	*24¼*	—	*71¾*		—	*275½*				*30*	*15*	*9½*
BALLINACLUNA														
Cath. Ryan & Son John	14	11¼	6	—	32	—	½ (Garden, Haggart, etc.)	64	1	15	0		9	[illegible]

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT, OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
BALLINACLUNA —*Contd.*										
Michl. McGuire & P. Flennie.	11½	15	2½	—	13	—	½ (Orchard)	42½	1 10 0	5 7 2
Thomas Ryan	17¼	4½	8¼	—	84¼	—	1¾ (Orchard, Haggart, etc.)	116	1 5 0	15 13 1
					144			144	5 0	
Edmd. Cormick ..	5½	3	5	—	3¼	—	—	17¼	1 0 0	1 9 5½
Pony. Barker Esqre. *Landlord* / could not learn the tenant's names.	12½	7	7	—	53½	—	—	80	15 0	5 1 8
Total for Holdings in Townland ..	*60¾*	*41*	*28¾*	—	*330¼*	—	*2¼*	*463¾*		*36 19 4½*
BRITTAS HILL										
Thos. & Patk. Hearn	3	—	2½	—	11½	—	—	17	1 0 0	1 9 0½
Michl. & Philp. Hearn	4	—	5	—	5	—	—	14	1 5 0	1 9 6
— Scully Esqre. *Landlord* / could not learn the tenants names.	9	—	—	—	91	—	—	100	5 0	2 7 11

PARISH OF KILMURRY—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
BRITTAS HILL *—Contd.*										
Pony. Barker, Esqre, *Landlord* / could not learn names of occupying tenants.	12¾	—	12¾	—	53¾	—	—	79¼	10 0	3 7 8
Total for Holdings in Townland ...	*28¾*	—	*20¼*	—	*161¼*	—	—	*210¼*		*8 14 1½*
CURRADOBBIN. (Curraghadobbin)										
Lord Clonmell	—	—	—	—	—	—	145 (Young Plantations).	145	3 0	2 5 4
Lord Clonmell, again / Landlord / could not learn the names of occupying tenants.	25	10	15	—	24	—	—	74	15 0	4 14 0½
Thomas White	15	18	11	—	61	—	5½ (Orchard, Garden, etc.)	110½	1 5 0	11 12 6
John Mangin	2½	1	3	—	3½	—	—	10	15 0	12 8½
Martin Fling	2	1	2	—	3	—	—	8	15 0	10 2
Widow Haubury	1½	—	1½	—	1	—	—	4	15 0	5 1
P. & J. Kennedy	3	—	2	—	2	—	—	7	15 0	8 11

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT, OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £	s.	d.	Amount of Composition for Tithe £	s.	d.
CURRADOBBIN —*Contd.*														
Willm. Power .	3	1	2	—	2	—	—	8		15	0		10	2
Edmd. & M. Rockett	3	1	2	—	2	—	—	8		15	0		10	2
Lauce. Butler	1¼	—	1¼	—	—	—	—	2½		15	0		3	2
John Shea ..	2	—	1½	—	—	—	—	3½		15	0		4	5
Widow Ryan ..	2	—	1	—	—	—	—	3		15	0		3	10
Michl. Walshe ...	24	18	—	—	35	—	1 (Orchard. etc.)	78	1	0	0	6	13	3
Pierce Rockett ...	8	18	7½	—	30½	—	—	64	1	10	0	8	1	4
Total for Holdings in Townland	*92¼*	*68*	*49¾*	—	*164*	—	*151½*	*525½*				*36*	*15*	*1*
RATHCLARISH.														
Widow Doran	3	1	3	—	10	—	—	17		10	0		14	6
Willm. Keating ..	6	2	5	—	27	—	—	40		10	0	1	14	2
Michl. Keating .	4	1	5	—	16	—	—	26		10	0	1	2	0
Val. Lanigan ...	6	2	8	—	32	—	—	48		10	0	2	1	0

PARISH OF KILMURRY—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
RATHCLARISH —*Contd.*														
Willm. & Michl Walshe	6	2	6	—	20	.		34		10	0	1	9	0½
John Brien	1	—	1	—	3	—	–	5		10	0		4	3
James Shea	1	—	1	—	1	—	—	3		10	0		2	7
Total for Holdings in Townland	*27*	*8*	*29*	—	*109*	—		*173*				*7*	*7*	*6½*

PARISH OF KILMURRY

RECAPITULATION

Townland	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	TOTAL
Ballynoran .	87¾	91¾	35¾	—	156¾	6½	7	385½
Mullough	72	55¼	22¼	—	93¼	3	7½	253¼
Figlash	84¼	80½	27¾	—	236¼	—	4	432¾
Macreary	86¾	52½	44¾	—	231½	1	61½	478
Ballyneal	135½	135¼	44¼	—	149	4	5	473
Ballycurkeen	25½	22	27	—	132½	—	3	210
Lisadobbin	66	92	8	—	53½	1½	½	221½
Ballinamona	121	101¼	58¾	—	103¾	—	½	385¼
Gurtnalua . . .	20	12½	13½	—	30	—	—	76
Ballydine	12¾	4½	—	—	56¼	—	1	74½
Butlerstown ...	94¼	85¼	24¼	—	71¾	—	—	275½
Ballinacluna	60¾	41	28¾	—	330½	—	2¾	463¾
Brittas Hill ...	28¾	—	20¼	—	161¼	—	—	210¼
Curradobbin	92¼	68	49¾	—	164	—	151½	525½
Rathclarish	27	8	29	—	109	—	—	173
Total for Parish (Irish Measure) .	1,014½	849¾	434	—	2.079¼	16	244¼	4637¾
Statute Measure	1,643	1,376	704	—	3.368	26	396	7513

COUNTY OF TIPPERARY AND WATERFORD*

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834

(2 & 3 Wm. IV. c. 119—Applotment Book No. 29).

PARISH OF KILSHEELAN—DIOCESE OF LISMORE.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
KILSHEELAN.														
Edmd. Power, Esqre.	—	—	—	—	1	—	11 (Plantation)	12	2	0	0	1	8	6
Patk. Hennessy ..	3¼	2¼	3	—	¼	—	—	9	1	5	0		13	3
John Hennessy	9¾	9	3	—	16¼	—	—	38	1	10	0	3	8	1
Jas. O Ryan. J. Hennessy & J. Halloran	9	3½	1¼	—	2	—	-	15¾	1	10	0	1	8	2
Patk. & Jno. Burke	24	28¼	8¼	--	38½	—	-	99	1	5	0	7	6	5
James Power (Miller)	1½	4¾	—	—	—	—	¼ (Garden, Haggart, etc.)	6½	1	10	0		11	8
Total for Holdings in Townland	*47½*	*48*	*15½*	-	*58*	—	*11¼*	*180¼*				*14*	*16*	*1*
GAMMONSFIELD														
James M. O Ryan	10½	9	4½	—	8	—	- -	32	1	5	0	2	7	4
Total for Holdings in Townland	*10½*	*9*	*4½*	—	*8*	—	—	*32*				*2*	*7*	*4*

*The Waterford section begins at Page 294

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £	s.	d.	Amount of Composition for Tithe £	s.	d.
POULAKERRY.														
James Delaney . .	17	13¾	7½	—	40¾	—	—	79	1	5	0	7	1	6
John Ryan & Jas. Hennessey .	12½	12½	6	—	11	—	—	42	1	5	0	3	2	1
Robt. O'Donnell, Esqre.	3	5½	—	—	1½	—	—	10	1	10	0		17	11
Willm. Delaney ..	5½	5½	—	—	16	—	2 (Orchard)	29	1	10	0	2	11	11
Willm. Butler, Esqre.	6	—	—	—	6	—	—	12	2	0	0	1	8	6
Total for Holdings in Townland ...	*44*	*37¼*	*13½*	—	*75¼*	—	*2*	*172*				*15*	*1*	*11*
BALLINRA. (Ballynaraha)														
John Miniken, Esqre.	4½	4½	—	—	20	—	—	29	3	0	0	5	3	11
Robert O'Donnell, Esq	4½	7	4½	—	5¼	—	—	21¼	1	10	0	1	17	7
Pierce O Donnell	18¾	16¾	10¾	—	10	—	1¾ (Orchard)	58	1	10	0	5	3	11
Mauce. Connolly ...	7	8	1	—	4	—	—	20	1	5	0	1	9	7
James Hayden	4	—	4½	—	43½	—	—	52	1	10	0	4	13	2
James Power	5½	8½	—	—	9	—	—	23	1	10	0	2	1	2
Willm. Keating . .	8	5	2½	—	2½	—	—	18	1	10	0	1	12	3

PARISH OF KILSHEELAN—COUNTIES OF TIPPERARY AND WATERFORD

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
BALLINRA—*Contd.*										
Philp. Keating ...	7	7½	—	—	3½	—	—	18	1 10 0	1 12 3
Edwd. & Jefy. Prendergast & P. Wall.	20	21½	6	—	9½	—	3 (Orchard)	60	1 5 0	4 8 9
Widow Burke .	12½	9	—	—	28½	—	—	50	1 10 0	4 9 7
Robt. O Donnell, Esq.	4¼	3¼	—	—	½	—	—	8	1 10 0	14 4
John Sullivan/ Publican.	6½	5¼	—	—	9¼	—	—	21	1 10 0	1 17 7
Total for Holdings in Townland ..	*102½*	*96¼*	*29¼*	—	*145½*	—	*4¾*	*378¼*		*35 4 1*
BALLYDINE.										
Patk. Walshe & Thos. Foran.	14	15¼	4	—	14¾	—	—	48	1 10 0	4 0 6
Thos. Lonergan ..	—	½	—	—	1	—	—	1½	1 10 0	2 8
James Power, Esqre.	—	—	10	—	46	—	—	56	2 0 0	6 13 0
Michl. & Jas. Hynes	2	3	—	—	—	—	—	5	1 10 0	8 11
Darbey Connell	9	4½	3½	—	8	—	—	25	1 10 0	2 4 9
Philp. Landy	9	9	2	—	9	—	—	29	1 10 0	2 11 11

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
BALLYDINE—*Contd.*										
Pierce Maddock . .	10½	6¼	—	—	8¼	—	—	25	1 5 0	1 16 11
Patk. Landy .	4½	5½	3	—	5	—	—	18	1 5 0	1 6 7
John Hyland .	6	7½	½	—	1½	—	—	15½	1 0 0	18 8
John Burke & Hackett	—	4	—	—	—	—	—	4	1 0 0	4 10
Patk. Sinnott	1	½	1½	—	1	—	—	4	1 0 0	4 10
Mr. Michl. Cormick	12½	7	8	—	26	—	—	53½	1 10 0	4 15 10
Willm. Dohey Senr.	4	—	3	—	1	—	—	8	1 10 0	14 4
Willm. Dohey Junr.	1½	—	1½	—	½	—	—	3½	1 10 0	6 3
Total for Holdings in Townland	*74*	*63*	*37*	—	*122*	—	—	*296*		*26 15 6*
MINERSTOWN. (Minorstown).										
Mr. Patk. Quinlan . .	18	26	6	—	108	—	—	158	1 15 0	16 9 2
Richd. Callaghan .	8½	9½	5	—	17	—	—	40	1 5 0	2 19 2
Total for Holdings in Townland	*26½*	*35½*	*11*	—	*125*	—	—	*198*		*19 8 4*

PARISH OF KILSHEELAN—COUNTIES OF TIPPERARY AND WATERFORD.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
MAGENSTOWN (Manganstown)														
Robt. Donnell Esqre.	10	18	--	—	47	—	3 (Garden, Orchard, etc.)	78	1	15	0	8	2	6
Mr. John Quinlan	15½	13	—	—	69½	—	—	98	1	15	0	10	4	2
Total for Holdings in Townland	*25½*	*31*	—	—	*116½*	—	*3*	*176*				*18*	*6*	*8*
KNOCKEEN OR GREENLAND ?(Greensland)														
Edmd. McGrath	5	8	1½	—	8½	—	—	23	1	5	0	1	14	0
Total for Holdings in Townland	*5*	*8*	*1½*	—	*8½*	—	—	*23*				*1*	*14*	*0*
BALLYGLASHINE (Ballyglasheen)														
Willm. Greene, Esqre	36	11	—	—	43	—	—	90	1	10	0	5	9	3
James Gorman & Pattners.	13½	13	—	—	6½	—	—	33	1	10	0	1	18	5
Total for Holdings in Townland ...	*49½*	*24*	—	—	*49½*	—	—	*123*				*7*	*7*	*8*

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
SESKIN.														
Widow O Donnell & Son John	66	63	14	—	165	—	4½ (Orchard) 1½ (Garden, Haggart, etc.)	314	1	10	0	83	8	2
Total for Holdings in Townland	*66*	*63*	*14*	—	*165*	—	*6*	*314*				*83*	*8*	*2*
SESKIN RUE.														
Edmd. Foran	12½	23	—	—	5½	—	—	41		15	0	5	9	6
Larkin & Donovan	1½	4	—	—	4½	—	—	10		15	0	1	6	8
James Commons ...	7½	2	2	—	3½	—	—	15		15	0	2	0	0
Michl. Gleeson	—	—	—	—	2	—	—	2		15	0		5	4
Maher & Galligan	3	11	2½	—	3½	—	—	20		15	0	2	13	4
James O Donnell ...	9	8	—	—	3	—	—	20		15	0	2	13	4
Brittan & Brien	8½	13	1½	—	5	—	—	28		15	0	3	14	9
Willm. Houlehan	2	2	—	—	—	—	—	4		15	0		10	8
Edmd. Bremigane....	4	3	—	—	2	—	—	9		15	0	1	4	1
Larkin & Powers	5	5	—	—	2	—	—	12		15	0	1	12	2

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Real Acreable Value £ s. d.	Amount of Composition for Tithe £ s. d.
SESKIN RUE—*Contd.*										
Philip Commons	9	15	2	—	3	—	—	29	15 0	3 17 4
Philip Commons	5	7	—	—	6	—	—	18	15 0	2 8 1
Jas. & John Mannin	5	11	1	—	1	—	—	18	15 0	2 8 1
Richd. Callaghan	—	2	—	—	½	—	—	2½	15 0	6 9
Patk. Houlehan	2½	—	1¾	—	—	—	—	4¼	15 0	11 5
Roberts & Crotty	12	6½	—	—	—	—	—	18½	1 0 0	3 3 11
Patk. Quirk	9	9	2	—	4¾	—	—	24¾	1 0 0	4 5 4
Edmd. Daniell	5½	6½	½	—	8	—	—	20½	1 0 0	3 10 11
Total for Holdings in Townland	*101*	*128*	*13¼*	—	*54¼*	—	—	*296½*		*42 1 8*
CLOUGHARRAGEEN (Cloghcarrigeen).										
Jas. M. Ryan & Stepn. Fennessey	1½	4	—	—	½	—	—	6	15 0	5 6
Ansty Hannigan	—	1½	—	—	1½	—	—	3	1 0 0	3 7
Widow Carey	3½	5	—	—	1	—	—	9½	1 0 0	11 5

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
CLOUGHARRAGEEN —*Contd.*										
Edmd. Keys ..	—	—	—	—	1½	—	—	1½	15 0	1 4
Total for Holdings in Townland . .	*5*	*10½*	—	—	*4½*	—	—	*20*		*1 1 10*
BALLINAGH.										
Willm. Greene Esqre.	16½	8½	—	—	45	—	—	70	1 5 0	5 3 6
Michl. Deady .	2½	—	—	—	14	—	—	16½	1 5 0	1 4 5
John S. Mandeville Esqre.	6	14	4½	—	28	—	½ (Haggart, etc.)	53	1 10 0	4 14 11
Total for Holdings in Townland ..	*25*	*22½*	*4½*	—	*87*	—	*½*	*139½*		*11 2 10*
CURTISTOWN										
Michl. Deady & Partners ..	6½	4½	—	—	21	—	½ (Garden, etc.)	32½	2 0 0	3 17 2
Total for Holdings in Townland . . .	*6½*	*4½*	—	—	*21*	—	*½*	*32½*		*3 17 2*

PARISH OF KILSHEELAN—COUNTIES OF TIPPERARY AND WATERFORD.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
NEWTOWNANNER										
Reps. of Sir Thos. Osborne	24	—	—	—	107	—	5 (Plantations) 2½ (Garden & Nursery) 1½ (Haggart, Offices, etc.)	140	3 0 0	25 1 8
Total for Holdings in Townland	*24*	—	—	—	*107*	—	*9*	*140*		*25 1 8*

COUNTY OF WATERFORD

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834

(2 & 3 Wm. IV. c. 119—Applotment Book No. 29).

PARISH OF KILSHELAN—DIOCESE OF LISMORE.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.
GURTEEN										
Edmd. Power Esqre.	32	7½	7	—	84	—	4½ (Home Offices, Garden & Small Plantation). 14 (Plantations 209 (Heathy, Pasture, Plantations, etc.)	149 209	2 0 0 4 0	38 6 6
Total for Holdings in Townland	*32*	*7½*	*7*	—	*84*	—	*227½*	*358*		*38 6 6*
LANDSCAPE.										
Mr. Sandy Lowe ..	11	—	—	—	22¾	—	4 (Plantations) Deduct 2¾ for ½ road. 1 (Garden, Offices, etc.)	38¾ 2¾ 36	3 0 0	6 9 0
John Congreve Esqre.	—	—	—	—	—	—	44 (Woodlands lately cut).	44	10 0	1 6 6
Michl. Whelan ...	—	2¼	—	—	—	—	—	2¼	1 10 0	4 4
John Hickey	—	3	—	—	—	—	—	3	2 0 0	7 0
Total for Holdings in Townland ..	*11*	*5¼*	—	—	*22¾*	—	*49*	*85¼*		*8 6 10*

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Real Acreable Value			Amount of Composition for Tithe		
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£	s.	d.	£	s.	d.
COOLESHIL. (Coolishal).														
Michl. Power & Partners or Edmd. Power Esqre.	39	—	14	—	—	—	490 (Heathy Pasture 300 (Woodlands)	843		4	0	12	5	9
Total for Holdings in Townland .	*39*	—	*14*	—	—	—	*790*	*843*				*12*	*5*	*9*
MOONEVAGH.														
Edmd. Power Esqre.	6	—	3	—	—	—	630 (Pasture, Heathy & Turbary.	639		4	0	9	6	0
Total for Holdings in Townland .	*6*	—	*3*	—	—	—	*630*	*639*				*9*	*6*	*0*
KNOCKNAREE.														
Edmd. Power Esqre. or John Grady & Partners.	42	—	20	—	120	—	150 (Woodlands)	182 150		5 3	0 0	4	11	1.
Total for Holdings in Townland .	*42*	—	*20*	—	*120*	—	*150*	*332*				*4*	*11*	*11*

PARISH OF KILSHEELAN—COUNTIES OF TIPPERARY AND WATERFORD.
RECAPITULATION.

Townland	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	TOTAL
Kilsheelan	47½	48	15½	—	58	—	11¼	180¼
Gammonsfield	10½	9	4½	—	8	—	—	32
Poulakerry ..	44	37¼	13½	—	75¼	—	2	172
Ballinra .	102½	96¼	29¼	—	145½	—	4¾	378¼
Ballydine	74	63	37	—	122	—	—	296
Minerstown ..	26½	35½	11	—	125	—	—	198
Magenstown	25½	31	—	—	116½	—	3	176
Knockeen or Greenland	5	8	1½	—	8½	—	—	23
Ballyglashine	49½	24	—	—	49½	—	—	123
Seskin	66	63	14	—	165	—	6	314
Seskin Rue ..	101	128	13¼	—	54¼	—	—	296½
Clougharrageen	5	10½	—	—	4½	—	—	20
Ballinagh	25	22½	4½	—	87	—	½	139½
Curtistown	6½	4½	—	—	21	—	½	32½
Newtown Anner	24	—	—	—	107	—	9	140

PARISH OF KILSHEELAN—COUNTIES OF TIPPERARY AND WATERFORD—*Continued.*

RECAPITULATION.

Townland	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	TOTAL
Gurteen	32	7½	7	—	84	—	227½	358
Landscape	11	5½	—	—	22¾	—	49	88¼
Cooleshil	39	—	14	—	—	—	790	843
Moonevagh	6	—	3	—	—	—	630	639
Knocknaree	42	—	20	—	120	—	150	332
Total for Parish .. (Irish Measure)	742½	593½	188	—	1.373¾	—	1883½	4781¼
Statute Measure ..	1203	961	305	—	2225	—	3051	7745

COUNTY OF TIPPERARY

AGRICULTURAL RTEURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834

(2 & 3 Wm. IV. c. 119—Applotment Book No. 29).

PARISH OF KILCASH—DIOCESE OF LISMORE.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value.	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
ARDBOY.											
Richard Butler	3½	—	1½	—	12½	—	—	17½	—	1 0 0	1 1 8
Cooney & Cordial	21¾	3½	7½	—	14	—	—	46¾	18 7	15 0	2 4 8
Michl. Mangin ...	—	—	—	—	13¾	—	—	13¾	17 1	15 0	13 1
Total for Holdings in Townland	*25¼*	*3½*	*9*	—	*40¼*	—	—	*78*			*3 19 5*
MOYLEDSTOWN. (Mayladstown).											
Lord Ormonde /apparently commanage/	—	—	—	—	—	—	120 (Heathy Pasture.)	120	—	4 0	2 0 0
Michl. Mangin /again/	7½	8¼	—	—	32¼	—	—	48	9 9	10 0	1 11 0
Hugh Fitzgerald ...	3	—	4	—	—	—	—	7	7 0	1 0 0	8 9
Richd. Hennessey & Nichs. Quin	6½	10	7	—	14¾	—	—	38¼	—	1 5 0	2 18 11
Michl. Hickey ...	—	—	—	—	28	—	—	28	7 0	5 10	1 6 10

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
MOYLEDSTOWN *—Contd.*											
Thomas Ryan	6	6	11½	—	28½	—	—	52	1 14 0	1 5 0	4 0 2
Total for Holdings in Townland	*23*	*24¼*	*22½*	—	*103½*	—	*120*	*293¼*			*12 5 9*
BALLINADUNA											
Thomas Ryan /again/	18½	8	3	—	11½	—	—	41	1 14 0	1 5 0	3 3 2
Total for Holdings in Townland	*18½*	*8*	*3*	—	*11½*	—	—	*41*			*3 3 2*
KILNERESEY. (Kylanoreashy).											
Pierce Hennessey & Michl. Maher	2¼	—	2¼	—	1½	—	—	6	—	1 5 0	9 2½
John Fribbs	12	10½	7	—	10½	—	—	40	—	1 5 0	3 1 8
Edmd. Meney	3½	2	—	—	—	—	—	5½	—	1 5 0	8 5½
Martin Rockett & Partner	21½	4¾	8	—	13¼	—	—	47½	—	1 5 0	3 13 2½
Richard Carroll	11	11	6		20	—	—	48	—	1 5 0	3 14 0

PARISH OF KILCASH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Rents paid.	Real Acreable Value	Amount of Composition for Tithe
									£ s. d.	£ s. d.	£ s. d.
KILNERRESEY —*Contd.*											
Barthw. Delaney ..	1	—	1	—	—	—	—	2	—	1 5 0	3 0½
Thomas Hogan	7½	10½	8¼	—	10¼	2½	—	39	—	1 0 0	2 8 9½
John Quinlan ...	5	—	5	—	3	—	—	13	—	1 5 0	1 0 1
Martin Hennessey	2½	3½	1½	—	2	—	—	9½	—	1 0 0	11 10
—— Dawson .	¾	¼	—	—	—	—	—	1½	—	1 0 0	1 10
Philp. Nugent ..	½	½	1	—	—	—	—	2	—	1 5 0	3 1
Willm. Shea/publican/	3	3	1½	—	—	—	—	7½	—	1 0 0	9 4½
Jefy. Power ...	8½	4	—	—	1½	—	—	14	—	1 5 0	1 1 7
Total for Holdings in Townland ...	79	50½	41½	—	62	2½	—	235½			17 6 2½
LISBOULTING. (Lisbalting)											
Nichs. Deady ..	6	7	3	—	6½	—	—	22½	1 4 0	1 5 0	1 14 8
Callanan & Brother	4	10¼	1½	—	6¾	—	—	22½	1 4 0	1 5 0	1 14 8
Willm. Hanigan ...	9	11	6½	—	17½	—	—	44	1 3 0	1 0 0	2 15 0
Total for Holdings in Townland ..	19	28¼	11	—	03¾	—	—	89			6 4 4

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Rents paid. £ s. d.	Real Acreable Value. £ s. d.	Amount of Composition for tithe. £ s. d.
KILCASH.											
Willm. Shea/Publican	2	2	1	—	2¾	—	—	7¼	1 10 0	1 5 0	11 2
Philp. Shea ..	1½	—	1	—	4½	—	—	7	1 14 6	1 5 0	10 9
Martin Nowlan .	1	1½	¾	—	½	—	—	3¾	1 5 6	1 0 0	4 7½
Thomas Deady ..	—	6	—	—	1¼	—	—	7¼	1 8 0	1 0 0	9 0
Willm. Mathw. & Cathrne. Hyland	20½	19½	21	—	52	—	—	112	1 15 0	1 10 0	10 7 2
Edmd. Reilly .	2½	4	—	—	1½	—	—	8	1 14 6	1 10 0	14 8
John Reilly .	4½	10	—	—	5	5	—	19½	1 14 2	1 10 0	1 15 8½
Bryan O'Donnell	21	12	8	—	33	—	—	74	—	1 5 0	5 14 1
John Butler	4	2	2	—	—	—	—	8	17 6	1 0 0	10 0
Patk. Ryan	2½	—	2¼	—	—	—	—	4¾	17 6	1 0 0	5 10
Mary Cantwell	2½	—	2½	—	—	—	2 (Pasture, etc.)	7 0	7 0	15 0	6 8
Michl. & Jas. Neal	18	—	13	—	33	—	—	64	—	15 0	3 1 4
Daniel Maher	3	—	3	—	—	—	—	6	11 6	10 0	3 11
Lord Ormonde/occupying tenant not known.	5¼	—	10½	—	—	—	7 (Heathy Pasture)	22¾	—	10 0	14 8

PARISH OF KILCASH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
KILCASH—*Continued*											
Lord Ormonde /again occupying tenants not known.	2	—	5	—	—	—	43½ (Heathy Pasture).	50½	—	5 0	18 11½
Danl. & Phil. Maher	2¾	—	3	—	7¼	—	—	13	11 0	10 0	8 5
Pierce Neal	3¼	—	—	—	—	—	—	3¼	—	15 0	3 1
Carroll & Stewart ..	1½	½	—	—	—	—	—	2	1 1 0	15 0	1 11
Denis Cormick ...	¾	—	½	—	—	—	—	1¼	—	10 0	10½
Patk. Whelan ...	9½	—	8¼	—	25	—	2½ (Garden, Haggart, etc.)	45¼	12 0	15 0	2 3 4
Michl. Hickey	27	21	9	—	54	—	—	111	1 14 2	1 5 0	8 11 2
Thomas Fitzpatrick	1	—	1	—	1	—	—	3	1 15 0	1 10 0	5 6
Michl. Moran ...	¼	—	1½	—	¾	—	—	2½	—	15 0	2 4½
Patk. Ryan	1	—	—	—	1½	—	—	2½	—	10 0	1 7½
Lord Ormonde	—	—	—	—	—	—	125 (Wood, Nursery, etc.)	125	—	5 0	2 6 10½
Total for Holdings in Townland	*137¼*	*78½*	*93¼*	—	*222¼*	—	*180*	*711¼*			*40 13 8½*

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value.	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
GLASHANISKEY. (Clashanisky).											
Roger Hanigan	13½	10½	11	—	37½	—	—	72½	1 4 0	1 5 0	5 11 9
Total for Holdings in Townland	**13½**	**10½**	**11**	—	**37½**	—	—	**72½**			**5 11 9**
TOUR. (Toor).											
Thomas Dempsey, Sen.	5½	—	6	—	11½	—	—	23	12 2	10 0	14 10
Thos. Dempsey, Junr.	2½	—	3	—	5	—	—	10½	11 3	10 0	6 9½
Richd. Madden	—	—	3½	—	6½	—	—	10	10 6	10 0	6 5½
Pierce Dempsey	4½	—	5¼	—	2	—	—	11¾	10 9	10 0	7 6½
Patk. Keane	4	—	3½	—	3¼	—	—	10¾	9 6	10 0	6 11
Cathne. Lawless	—	—	1	—	¾	—	—	1¾	9 6	10 0	1 1
Patk. Lawless	4	—	4	—	2	—	—	10	9 6	10 0	6 5½
Willm. Lawless	5	—	3	—	2	—	—	10	9 6	10 0	6 5½
Richd. Strang	2	—	2	—	6	—	—	10	10 0	10 0	6 5½

PARISH OF KILCASH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
TOUR—*Continued*											
Thomas Usher	1	—	—	—	—	—	—	1	15 0	10 0	8
Richd. Walshe ..	2¼	—	5	—	4	—	—	11¼	11 1	10 0	7 7
Willm. Flood	6	—	4	—	4	—	—	14	10 4	10 0	9 0½
Philp. Walshe	2	—	—	—	1	—	—	3	14 0	10 0	1 11
Patk. Kehoe	5	—	3	—	2¼	—	—	10¼	9 6	10 0	6 7½
Oliver Morrissey	6½	—	2	—	4¼	—	—	12¾	10 3	10 0	8 2
Eleanr. Stokes	6	—	2	—	10¼	—	—	18¼	10 0	10 0	11 9½
Abm. Strang	3½	—	7	—	6¼	—	—	16¾	10 10	10 0	10 9
Pierce Maughan	3	—	6	—	6¾	—	—	15¾	10 10	10 0	10 1
Margt. Butler	3	—	2½	—	4½	—	—	10	9 0	10 0	6 6
Connell & Britt	7	—	5	—	3	—	—	15	14 0	10 0	9 8
Edmd. Walshe	4	—	3	—	3	—	—	10	12 6	10 0	6 6
Willm. Shunny	—	—	1	—	4	—	—	5	14 10	10 0	3 3
Daniel Hayden	3	—	1	—	6	—	—	10	10 5	10 0	6 6

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
TOUR—*Continued*											
Edmd. Singen ...	7	—	7	—	6	—	—	20	14 3	10 0	12 11
Eleanr. Stokes ...	3	—	1	—	6¼	—	—	10¼	14 0	10 0	6 8
Pierce Maughan .	5	—	3	—	1½	—	—	9½	14 10	10 0	6 2
Abm. Strang ..	2	—	4	—	4¾	—	—	10¾	14 6	10 0	6 11
Lauce. Corbett ..	5	—	2½	—	8½	—	—	16	9 8	10 0	10 4
John Dunphy ...	1½	—	1	—	10	—	—	12½	9 10	10 0	8 0½
James Connell	2	—	—	—	4½	—	—	6½	10 0	10 0	4 2½
James Connors	3½	—	—	—	—	—	—	3½	17 0	10 0	2 2
Thomas Clifford	5	—	3	—	4¼	—	—	12¼	9 3	10 0	7 11
Tobs. Clifford & Partners.	4	—	5	—	15	—	—	24	9 3	10 0	15 6
James Wallace & Partners.	4	—	2	—	19	—	—	25	9 4	10 0	16 2
Willm. Walshe & Donovan.	6	—	5	—	12	—	—	23	9 6	10 0	14 10
Total for Holdings in Townland	*127¾*	—	*106¼*	—	*190*	—	—	*424*			*13 13 10½*

PARISH OF KILCASH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
KNOCKRATHKELLY											
Bryan & O Donnell	4½	—	10	—	12½	—	—	27	9 3	15 0	1 5 10
Willm. Walshe ...	9½	—	6½	—	12½	—	—	28½	9 3	15 0	1 7 3
Total for Holdings in Townland	*14*	—	*16½*	—	*25*	—	—	*55½*			*2 13 1*
CARRIGALOE.											
John Brittan	1	—	½	—	—	—	—	1½	1 0 0	15 0	1 5
Mary Cantwell ...	—	—	—	—	1½	—	—	1½	1 0 0	15 0	1 5
John McGrath	½	—	2	—	1	—	—	3½	19 0	15 0	3 4½
John Donovan ...	—	—	½	—	1½	—	—	2	1 0 0	15 0	1 11
James Maher	—	—	—	—	3¾	—	—	3¾	1 0 0	15 0	3 7
Dalton Hogan & Blake.	2	—	—	—	—	—	—	2	—	10 0	1 3½
James Farrell	4	—	8	—	9	—	—	21	11 8	10 0	13 7
Margaret Kelly	1½	—	4	—	4	—	—	9½	8 6	10 0	6 2
Michl. Cantwell	4½	—	2	—	3	—	—	9½	8 6	10 0	6 2
Patk. Keane	4	—	3	—	6	—	—	13	16 .7	15 0	12 6

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value.	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
CARRIGALOE—*Contd.*											
Edmd. Shea	8½	—	4½	—	—	—	—	13	17 0	15 0	12 6
Richd. Butler ..	2	—	1½	—	—	—	—	3½	17 6	15 0	3 4½
Mathw. Shea ..	6	—	4¾	—	10	—	—	20¾	18 2	15 0	19 10½
Lord Ormonde	—	—	—	—	—	—	70 (Wood) 50 (Heathy Pasture).	120	—	5 0	2 5 0
Lord Ormonde (again)	—	—	—	—	—	—	125 (Rocky Heathy Pasture).	125	—	3 0	1 13 11
Total for Holdings in Townland	*34*	—	*30¾*	—	*39¾*	—	*245*	*349¼*			*8 6 1*

PARISH OF KILCASH—COUNTY OF TIPPERARY.

RECAPITULATION.

Townland	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	TOTAL
Ardboy	25¼	3½	9	—	40¼	—	—	78
Moyledstown	23	24¼	22½	—	103½	—	120	293¼
Ballinaduna ...	18½	8	3	—	11½	—	—	41
Kilnercsey ...	79	50½	41½	—	62	2½	—	235½
Lisboulting	19	28¼	11	—	30¾	—	—	89
Kilcash	137¼	78½	93¼	—	222½	—	180	711½
Glashaniskey	13½	10½	11	—	37½	—	—	72½
Tour	127¾	—	106¼	—	190	—	—	424
Knockrathkelly	14	—	16½	—	25	—	—	55½
Carrigaloe	34	—	30¾	—	39¾	—	245	349½
Total for Parish (Irish Measure)	491¼	203½	344¾	—	762¾	2½	545	2349¾
Statute Measure ...	796	330	558	—	1236	4	883	3807

COUNTY OF TIPPERARY

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834

(2 & 3 Wm. IV. c. 119—Applotment Book No. 29).

PARISH OF KILTEGAN—DIOCESE OF LISMORE.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding			
BALLINGARRANE									£ s. d.	£ s. d.	£ s. d.
William Cooney ...	7	10	1½	—	14½	—	—	33	4 5 0	4 0 0	6 7 10
Cathne. Sullivan Widow	½	3½	—	—	—	—	—	4	4 5 0	4 0 0	15 4
James Power	5	4½	—	—	7½	—	½ (House. Haggart, etc)	17½	5 0 0	3 10 0	2 18 10½
Willm. H. Bradshaw Esqre.	—	—	—	—	77	—	3¼ (Hill Pasture).	80¼	3 15 0	4 0 0	15 10 9
Total for Holdings in Townland .	*12½*	*18*	*1½*	—	*99*	—	*3¾*	*134¾*			*25 12 9½*
GLENCONNER											
John Bagwell, Esqre	—	—	—	—	17	—	½ (House, Garden, etc.)	17½	8 0 0	5 0 0	4 2 10½
Willm. White	2½	2	—	1¾	2¼	—	—	8½	4 4 0	4 0 0	1 12 9
Mary Murphy Widow	—	—	—	—	15¼	—	1 (Hill Pasture) 1¾ (Orchards)	18	3 16 0	3 0 0	2 13 2
Pierce Power .	4	—	4	4	4½	—	4½ (Hill Pasture).	21	3 16 0	3 0 0	3 1 11½

AGRICULTURAL RETURNS BY TITHE COMPOSITION APPLOTMENT, 1834.

Townland and Occupiers	ACRES—IRISH MEASURE: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Rents paid.	Real Acreable Value.	Amount of Composition for Tithe
									£ s. d.	£ s. d.	£ s. d.
GLENCONNER—*Contd*											
Michl. Ahearne ...	4½	4	3	—	7	—	½ (Passage or Road).	19	—	4 0 0	3 13 5½
Andw. Hally	3	—	—	—	4	—	1 (Orchard)	8	7 0 0	4 0 0	1 10 10
Richd. Moore Esqre.	½	—	—	2	28	—	¾ (Orchard) ¾ (Garden, etc)	32	6 10 0	5 0 0	7 11 10
John Kiely	1½	1	—	—	—	—	—	2½	5 0 0	4 0 0	9 7
Patk. Hennessy	½	—	—	—	—	—	—	½	—	4 0 0	9
Thos. Farrell ..	—	—	—	—	2½	—	—	2½	5 0 0	4 0 0	9 7
Total for Holdings in Townland	*16½*	*7*	*7*	*7¾*	*80½*	—	*10¾*	*129½*			*25 7 9½*
GARRYROE.											
Thos. Prendergast	6	5	2	—	34½	—	—	47½	3 16 0	3 0 0	7 0 4
Edmd. Cooney . .	3½	3½	7	—	21	—	—	35	—	2 10 0	4 7 5
Michl. Keily	13	13½	5¼	1¼	11	—	½ (Lime Kiln, etc.) ½ (Waste attached to do.)	45	2 15 5	2 0 0	4 13 8
Total for Holdings in Townland ...	*22½*	*22*	*14¼*	*1¼*	*66½*	—	*1*	*127½*			*16 1 5*

PARISH OF KILTEGAN—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
LAWLESSTOWN.											
Edmd. Heffernan	6	3	—	—	1	—	—	10	2 15 5	1 10 0	15 8
Thos. Griffin	4½	4¼	4	1¼	8	—	1 (Haggart, Garden, etc.)	23	2 15 5	2 0 0	2 7 10
Willm. Tobin	—	10	—	—	2	—	—	12	—	2 10 0	1 10 10
Michl. Harty	4	3	—	—	—	—	—	7	2 0 0	1 5 0	9 6
Patk. Tobin	5½	12¼	5	—	8½	—	¾ (Garden, Haggart, etc.)	32	3 0 0	2 0 0	3 6 6
Michl. Brien	6¼	12½	6½	—	10½	—	1 (Passage or Road).	39	—	1 10 0	3 1 7
Alice Ahearne	4½	10½	3½	—	10	—	2¼ (Orchard) ½ (cabbage Garden, Haggart)	29	—	1 10 0	2 5 9
Total for Holdings in Townland	*30¾*	*55½*	*19*	*1¼*	*40*	—	*5½*	*152*			*13 17 8*
TUBBERAHANA (Toberaheena)											
Chas. Riall Esqre.	3½	4	—	—	28¼	—	½ (Road or Passage) ¼ (House, yard, etc.) 3¼ (Orchard)	39¾	—	4 0 0	7 13 10

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
TUBBERAHANA —*Contd.*											
Edmd. Dawley ...	3½	3½	—	—	5	—	—	12	5 11 11	4 0 0	2 6 4
Patk. Dawley	—	4¼	3	—	3	—	—	10¼	5 18 0	4 0 0	1 19 6
Total for Holdings in Townland	*7*	*11¾*	*3*	—	*36¼*	—	4	*62*			*11 19 8*
BALLYVEELISH.											
Michl. Ahearn	—	—	—	—	9¼	—	—	9¼	—	1 10 0	14 6
Total for Holdings in Townland	—	—	—	—	*9¼*	—	—	*9¼*			*14 8*

PARISH OF KILTEGAN.

RECAPITULATION

Townland	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	TOTAL
Ballingarrane	12½	18	1½	—	99	—	3¾	134¾
Glenconner ...	16½	7	7	7¾	80½	—	10¾	129½
Garryroe	22½	22	14¼	1¼	66½	—	1	127½
Lawlesstown	30¾	55½	19	1¼	40	—	5½	152
Tubberahana ...	7	11¾	3	—	36¼	—	4	62
Ballyveelish .	—	—	—	—	9¼	—	—	9¼
Total for Parish .... (Irish Measure)	89¼	114¼	44¾	10¼	331½	—	25	615
Statute Measure	145	185	72	17	537	—	40	996

COUNTY OF TIPPERARY

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834

(2 & 3 Wm. IV. c. 119—Applotment Book No. 29).

PARISH OF DERRYGRATH—DIOCESE OF LISMORE.

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Rents paid.	Real Acreable Value	Amount of Composition for Tithe
DERRYGRATH									£ s. d.	£ s. d.	£ s. d.
Alice Prendergast / Widow /	14¼	18	13¼	—	53	—	—	98½	—	1 10 0	7 1 7
Maurice Farrell	3	3½	2	1½	—	—	—	10	—	1 10 0	14 4½
John Ryan ...	2¼	2½	¼	—	—	—	—	5	—	2 0 0	9 7
Edmd. Prendergast	12	25	3¾	—	18½	4	—	63¼	2 10	2 0 0	6 2 5
Willm. Prendergast	3	17	13	—	4	2	—	39	—	2 0 0	3 15 5
Michael & Wilm. Coman (Conran)	2	2	—	—	¾	—	—	4¾	3 0 0	2 0 0	9 1
James Ryan ..	1¼	2¼	1½	—	—	—	—	5	—	2 10 0	12 3
Widow Tyrell ...	1	1	—	—	—	—	—	2	—	1 10 0	2 10½
Michl. Hackett ...	1	1	—	—	¼	—	—	2¼	—	1 10 0	3 3
John Conry ...	1	1	—	—	—	—	—	2	—	2 0 0	3 9
Willm. Heffernan ...	3¼	8	—	13¼	23	13	—	60½	—	2 0 0	5 15 1
Widow Heffernan & Wilm. Kennedy	12	10	7½	—	47	—	—	76½	—	2 0 0	7 8 0

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value.	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
DERRYGRATH —*Contd.*											
Timy. Doyle	2¼	7½	2½	1½	3	2	—	18¾	—	1 10 0	1 6 11½
Garrett Nugent	5½	10	3½	7½	12½	1	—	40	—	1 10 0	2 176
Patk. Heffernan	9½	13½	9	—	27	9¼	—	68¼	—	2 0 0	6 12 1
Willm. Heffernan . .	7½	13½	14¾	—	14¾	2¾	—	53¼	—	2 0 0	5 3 0
John Prendergast / Glebe land /	3½	4	1½	—	4¼	¾	3 (Plantation, etc.)	17	—	1 15 0	1 10 5
John O Donnell .	5	2	8	—	7	—	—	22	—	2 10 0	2 13 11½
Total for Holdings in Townland .	*89¼*	*141¾*	*80½*	*23¾*	*215*	*34¾*	*3*	*588*			*53 3 7*
GARRYROE.											
John O Donnell /again/	—	5¾	3¼	—	5	—	5½ (Orchard) 1½ (Plantation)	21	—	2 10 0	2 11 6
Thomas Coffey . .	—	1	1	1¼	—	—	—	3¼	—	2 10 0	7 10½
Total for Holdings in Townland . .	—	*6¾*	*4¼*	*1¼*	*5*	—	*7*	*24¼*			*2 19 4½*

PARISH OF DERRYGRATH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Rents paid. £ s. d.	Real Acreable Value £ s. d.	Amount of Composition for Tithe £ s. d.
NICHOLSTOWN											
Thos. & Michl Coffey	2½	8	2½	—	2	—	—	15	—	2 0 0	1 9 0
Willm. Wall	3	5	3¼	—	5½	5½	—	22¼	—	2 0 0	2 3 0
Patk. Wall	3	11	6	2½	10½	3½	—	36½	—	1 10 0	2 12 5½
Mary O'Connor / Widow	20	21¾	13½	—	25	8	—	88¼	—	1 15 0	7 18 0
Patk. Hackett	2½	4¼	—	—	4½	—	—	11¼	—	2 0 0	1 1 8
Pierce Keating ...	7	7	1½	2½	4	3	—	25	—	2 0 0	2 8 3
Patk. Cleary	4¼	6½	2½	—	5½	—	—	18¾	—	2 0 0	1 16 2
Denis Keane	2¼	3	2½	2	2¼	1½	—	13½	1 7 6	1 5 0	16 0½
Luke Keane	1	2½	2½	—	—	—	¾ (Road, etc.)	6¾	1 7 6	1 5 0	8 0
Willm. Keane	3	2½	½	—	—	—	¾ (Road, etc.)	6¾	1 7 6	1 5 0	8 0
Total for Holdings in Townland	*48½*	*17½*	*34¾*	*7*	*59¼*	*21½*	*1½*	*244*			*21 0 7*
BALLINDUNNY.											
John Keating	2	2	—	—	2¾	—	½ (Road etc.)	7¼	—	2 0 0	14 0

Townland and Occupiers	ACRES—IRISH MEASURE: Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Rents paid. £ s. d.	Real Acreable Value £ s. d.	Amount of Composition for Tithe £ s. d.
BALLINDUNNY —*Contd.*											
Mary O'Brien /Widow/	11½	11½	5	10	12	2	—	52	—	2 0 0	5 0 7
Patk. O Brien ..	3	—	4	—	7½	2	—	16½	—	2 0 0	1 11 10
Widow Going	1¼	½	—	—	—	—	—	1¾	—	2 0 0	3 5
John Going .	½	1	—	—	—	—	½ (Quarry, etc.)	2	—	1 10 0	2 10½
Patk. Lamb .	4	10	—	4	5	3	—	26	—	1 10 0	1 17 5½
Lauce. Keating ..	2½	2	—	—	½	—	—	5	—	2 0 0	9 7
Danl. Ahearne .	3½	6¾	—	¼	3¾	1¼	—	15½	—	2 0 0	1 9 11
Blanchfield & Widow Fogarty /late Dwyer & Griffin.	8¾	11	3	—	3¼	—	—	26	—	2 0 0	2 10 3
Thomas Fennessy .	3½	4½	½	—	—	—	—	8½	—	2 0 0	16 4
David & James Fennessy	7½	4¾	2	—	3	—	—	17¼	—	2 0 0	1 13 4
Thomas Hickey	2½	2¼	—	—	1¼	—	—	6	—	2 0 0	11 6
Pierce Keating	1¾	—	1¾	—	1	—	—	4½	—	1 10 0	6 5
Michl. Keating and —— Moran	9	10½	2½	—	3	—	—	25	—	1 15 0	2 4 9

PARISH OF DERRYGRATH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
BALLINDUNNY —*Contd.*											
Stephen Morrissey	5	6¼	4½	3	6¼	—	—	25	—	2 0 0	2 8 3
John Morrissey	6½	8	5	—	7½	1¼	—	28¼	—	2 0 0	2 14 7
Widow Duan	2½	2	—	1¾	—	—	—	6¼	2 0 0	1 15 0	11 1
Michl. Coffey ..	¼	2	½	—	1	½	—	4¼	2 10 0	2 0 0	8 3
John Coffey .	1¼	—	—	—	3¼	—	—	4½	2 10 0	2 0 0	8 7
John Hennessy . .	½	½	—	—	—	—	—	1	—	2 0 0	1 11
James Maher	¾	—	¾	—	—	—	—	1½	—	2 0 0	2 11
Total for Holdings in Townland .	*78*	*85½*	*29½*	*19*	*61*	*10*	*1*	*284*			*26 7 10*
CLUNAMACODY. (Cloghanacody).											
Jas. & Jno. Hanrahan	1¾	1½	¾	—	¾	—	—	4¾	—	2 0 0	9 1
David Lonergan	3	1½	¾	—	—	—	—	5¼	—	2 0 0	10 1
Wm. Farrell ..	3½	3½	—	—	1½	—	—	8½	—	2 0 0	16 4
Denis Walshe ...	4¼	4	2¼	—	1	—	—	11½	—	2 0 0	1 2 2

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
CLUNAMACODY. *—Contd.*											
James Hanrahan	—	5	2	—	—	—	—	7	—	2 0 0	13 6
Total for Holdings in Townland	*12½*	*15½*	*5¾*	—	*3¼*	—	—	*37*			*3 11 2*
KILMALOGUE											
Willm. Quin Esqre	6	—	2	—	56½	—	5½(Fox cover)	70	—	2 0 0	6 15 6
Edmd. Hally, Junr.	3½	5	—	—	¼	—	—	8¾	—	2 0 0	16 10
Edmd. Hally Senr.	3¼	2¾	1	—	4½	—	—	11½	—	2 0 0	1 2 2
John Fitzgerald	4	3	—	—	3	—	—	10	—	2 0 0	19 3
John Hogan & Brother	1¾	1	½	1	½	—	—	4¾	—	2 0 0	9 1
Widow Griffin	10	4	1¼	—	5	—	—	20¼	—	2 0 0	1 19 2
Michl. Connell	3¼	3	3	—	2	—	—	11¼	—	2 0 0	1 1 8
John Green	4¾	3¼	1	—	—	—	—	9	—	2 0 0	17 4
Mary Burke, Widow	½	—	1	1¾	2¼	—	—	5½	—	1 15 0	9 9½
Cors. Wallis	1	8	2½	—	—	—	—	11½	—	2 0 0	1 2 2

PARISH OF DERRYGRATH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value.	Amount of Composition for Tithe.
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
KILMALOGUE *Contd.*											
James Maher ..	2½	2½	1½	1½	1	—	—	9	—	2 0 0	17 4
Denis Morrissey .	6½	2½	—	2	3¾	—	—	14¾	—	1 15 0	1 6 4
Andrew Morrissey .	9½	17½	8¾	8	2¾	—	—	·2¾	—	2 0 0	3 18 4
Patk. Morrissey .	2	3	2½	—	2½	2¼	—	12¼	—	1 10 0	17 8
John Lonergan ...	6	6¾	11	—	10¼	1	—	35	—	2 0 0	3 7 8
Widow T. Egan	3½	5¼	2	2¼	1½	—	—	14½	—	1 10 0	1 1 2
Widow John Egan	13½	7½	8	6¼	3	3¼	—	42	1 10 0	1 15 0	3 15 2
Widow Egan ..	9	13	9½	4½	7	1	—	44	—	1 10 0	3 3 4
James Hally /now John	½	2½	2	1½	2½	—	—	9	—	1 15 0	16 1
Thomas Lonergan ...	¼	—	¼	—	—	—	—	½	—	1 10 0	8¼
Total for Holdings in Townland ...	*91¼*	*90¾*	*57¼*	*23¼*	*108¼*	*7½*	*5¼*	*384¼*			*34 16 9*
LISRAMUCKA.											
Luke Hally	15½	44	12½	20	79	17	6 (Orchard)	194	—	1 10 0	13 18 11½
James Hally .	2½	2½	—	2½	1¼	—	—	8¾	—	1 15 0	15 6¼

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value.	Amoun of Comptosition for tithe.
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
LISNAMUCKA *—Contd.*											
Willm. Riordan ..	½	¾	—	—	—	—	—	1¼	—	1 10 0	1 9
James Riordan ..	1¼	2¼	¼	—	—	—	—	4¼	1 15 0	1 10 0	6 1
Total for Holdings in Townland ..	*19¾*	*49½*	*13¼*	*22½*	*80¼*	*17*	*6*	*208¼*			*15 2 4*
CRUTTAGE OR GRANGE.											
Mary O'Neill/Widow/	4¼	4½	1¾	—	3½	1	—	15	—	2 0 0	1 9 0
John Gardiner	5	2	3	4	1	—	—	15	—	2 0 0	1 9 0
Willm. Shaw ..	¾	1	—	—	—	—	—	1¾	1 10 0	2 0 0	3 5
Willm. Hennessey	2½	1¾	1¼	—	1¼	—	—	6¾	1 10 0	2 0 0	12 11
James Murphy ..	¾	1¼	½	—	1	—	—	3½	1 10 0	2 0 0	6 9
Thomas Quirk	—	—	4	—	—	3	—	7	—	1 10 0	10 1
John Moore .	2½	3¼	1¾	—	½	—	—	8	—	1 10 0	11 6
Thomas Moore	1½	3	—	1	½	—	—	6	—	2 0 0	11 6
Total for Holdings in Townland	*17¼*	*16¾*	*12¼*	*5*	*7¾*	*4*	—	*63*			*5 14 2*

PARISH OF DERRYGRATH—COUNTY OF TIPPERARY.

Townland and Occupiers	Acres—Irish Measure								Rents paid.	Real Acreable Value.	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
THOMASTOWN											
James Lonergan ..	2	1¾	¼	—	½	—	—	4½	—	2 0 0	8 7
John & Timy. Guidra	15	16½	6	—	6	2	—	45½	—	1 15 0	4 1 4½
John Noonan .	1	2	2	—	1	—	—	6	—	2 0 0	11 6
James Donohue (now Widow)	3	5½	1½	—	1	—	—	11	—	2 0 0	1 1 3
Willm. Keating (now Widow	3	5½	1½	—	1	—	—	11	—	2 0 0	1 1 3
James Farrell	1¼	1	—	—	—	—	—	2¼	—	2 0 0	4 4
Mathw. Buckley	1	1¼	—	—	—	—	—	2¼	—	2 0 0	4 4
Total for Holdings in Townland .	*26¼*	*33½*	*11¼*	—	*9½*	*2*	—	*82½*			*7 12 7½*
KNOCKINRICHARD											
Robt. & Jno. Martin	17	13¾	7	3	4½	½	—	45¾	—	1 15 0	4 1 9½
Total for Holdings in Townland	*17*	*13¾*	*7*	*3*	*4½*	*½*	—	*45¾*			*4 1 9½*
MARKHAMSTOWN											
Timothy Guidra ..	3½	10	—	—	3¼	1½	—	18¼	1 10 0	1 10 0	1 6 2
John & Cors. Guidra	7	12¾	2½	½	3½	8	—	34¼	1 10 0	1 10 0	2 9 3
Total for Holdings in Townland .	*10½*	*22¾*	*2½*	*½*	*6¾*	*9½*	—	*52½*			*3 15 5*

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value	Amount of Composition for Tithe
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
KNOCKMUDDA.											
John Ruddy	9	4	4	—	4	—	—	21	—	2 0 0	2 0 6
Total for Holdings in Townland	*9*	*4*	*4*	—	*4*	—	—	*21*			*2 0 6*
GARNAVELLA.											
Tim. & Jno. Luddy	1	2¼	—	1¾	2	—	—	7	—	1 10 0	10 1
Thos. English & Ryan	2	2	—	—	—	—	—	4	—	2 0 0	7 9
John Nugent	2½	—	4	—	—	—	—	6½	—	2 0 0	12 6
Total for Holdings in Townland	*5½*	*4¼*	*4*	*1¾*	*2*	—	—	*17½*			*1 10 4*
COMMONS ENTIRE											
John Burke & Casey	2¾	1	2	—	—	—	—	5¾	2 10 0	1 15 0	10 4
John Griffin	¾	—	1	—	¼	—	—	2	2 10 0	1 10 0	2 10½
Thos. Corcey & Murphy	3	3¾	¾	—	½	—	—	8	2 10 0	1 10 0	11 6
Jerh. Maher	1	1½	1½	—	—	—	—	4	2 10 0	2 0 0	7 9
James Maher	1½	5	2½	—	2	2¼	—	13¼	2 10 0	1 15 0	1 3 9

PARISH OF DERRYGRATH—COUNTY OF TIPPERARY.

Townland and Occupiers	ACRES—IRISH MEASURE Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	Rents paid.	Real Acreable Value	Amount of Composition for Tithe
									£ s. d.	£ s. d.	£ s. d.
COMMONS ENTIRE —*Contd.*											
Mathw. Fogarty ..	¾	¼	—	—	—	—	—	1½	2 15 0	1 15 0	2 8
Willm. Kenna	2½	2¾	—	—	1¾	—	—	7	2 15 0	2 0 0	13 6
John Hickey .	1¼	¾	—	—	—	—	—	2	—	1 10 0	2 10½
Total for Holdings in Townland ..	*13½*	*15½*	*7¾*	—	*4½*	*2½*	—	*43½*			*3 15 3*
WOODRUFFE. (Woodrooff).											
Wm. Perry Esqre.	—	10	—	—	—	—	186 (Pasture Plantations etc.)	196	—	4 0 0	40 0 2
Total for Holdings in Townland	—	*10*	—	—	—	—	*186*	*196*			*40 0 2*
"TOWNLAND NOT KNOWN"											
James Dower ..	1¾	1¾	—	—	—	—	—	3½	—	1 15 0	6 3
Darbey Skehan	—	—	4¾	1	—	—	—	5¾	—	2 0 0	11 0
James Doyle . .	¾	—	¾	—	¼	—	—	1¾	—	1 15 0	3 1½

AGRICULTURAL RETURNS FROM TITHE COMPOSITION APPLOTMENT OF 1834.

Townland and Occupiers	ACRES—IRISH MEASURE								Rents paid.	Real Acreable Value.	Amount of Composition for Tithe.
	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area of Holding	£ s. d.	£ s. d.	£ s. d.
"TOWNLAND NOT KNOWN"—(*Contd.*)											
Michl. Maher	1¾	3	1	—	¼	—	—	6	—	1 15 0	10 9½
Willm. Maher	2¼	2¾	—	—	1½	—	—	6	—	1 15 0	10 9½
Thomas Keating	1½	3	—	2¾	—	—	—	7¼	—	2 0 0	14 0
Mauce. Dalton/now Wm. O Donnell	5½	3½	2	3¼	5	½	—	19¾	—	2 0 0	1 18 0
Total for Holdings in Townland	*13½*	*13½*	*[illegible]½*	*7*	*7*	*½*	—	*50*			*4 14 1½*

PARISH OF DERRYGRATH.

RECAPITULATION.

Townland	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	TOTAL
Derrygrath . .	89¼	141¾	80½	23¾	215	34¾	3	588
Garryroe	—	6¾	4¼	1¼	5	—	7	24¼
Nicholstown	48½	71½	34¾	7	59¼	21½	1½	244
Ballindunny	78	85½	29½	19	61	10	1	284
Clunamacody	12½	15½	5¾	—	3¼	—	—	37
Kilmalogue .	91¼	90¾	57¾	23¼	108¼	7½	5½	384¼
Lisnamucka . . .	19¾	49½	13¼	22½	80¼	17	6	208¼
Cruttage or Grange	17¼	16¾	12¼	5	7¾	4	—	63
Thomastown .	26¼	33½	11¼	—	9½	2	—	82½
Knockinrichard .	17	13¾	7	3	4½	½	—	45¾
Markhamstown . .	10½	22¾	2½	½	6¾	9½	—	52½
Knockmudda	9	4	4	—	4	—	—	21
Garnavella . .	5½	4¼	4	1¾	2	—	—	17½

PARISH OF DERRYGRATH—*Continued.*

RECAPITULATION.

Townland	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	TOTAL
Commons Entire	13½	15½	7¾	—	4½	2¼	—	43½
Woodruffe	—	10	—	—	—	—	186	196
Townland not known	13½	13½	8½	7	7	½	—	50
Total for Parish (Irish Measure)	451¾	595¼	283	114	578	109½	210	2341½
Statute Measure	732	964	458	185	936	178	340	3793

THURLES TITHE BOOK*

ACREAGE, PRODUCE AND PRICES.

Name, Address and Year	Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
No. 14.						
Timothy Cahell, Thurles						
(1829)						
Wheat	2¼	13½ bl.	27 st. at 15d. per st.	1	13	9
Potatoes	3	180 bl.	18 bl. at 5s. per bl.	4	10	0
Meadow	1	2 tn.	4 cwt at 2s. per cwt.		8	0
do. (1830)						
Meadow	1	2 tn.	4 cwt. at 2s. per cwt.		8	0
Wheat	3	21 bl.	2 bl. and 2st. at 25s. per bl.	2	12	6
Potatoes	1¼	75 bl.	7½ bl. at 3s. per bl.	1	2	6
Oats	1	10 bl.	1 bl. at 10s. per bl.		10	0
No. 15.						
Patrick Cahell, Thurles						
(1828)						
Wheat	½	50 st.	5 st. at 15d. per st.		6	3
Potatoes	½	25 bl.	2½ bl. at 3s. per bl.		7	6
(1829)						
Wheat	½	40 st.	4 st. at 15d. per st.		5	0
Potatoes	½	20 bl.	2 bl. at 5s. per bl.		10	0
do. (1830)						
Wheat	½	3 bl.	6 st. at 15d. per st.		7	6
Potatoes	½	30 bl.	3 bl. at 3s. per bl.		9	0
16.						
James Dakers, Thurles						
(1829)						
Wheat	½	50 st.	5 st. at 15d. per st.		6	3
Potatoes	2	120 bl.	12 bl. at 5s. per bl.	3	0	0
Barley	½	3 bl.	4½ st. at 10d. per st.		3	9
do. (1830)						
Potatoes	½	35 bl.	3½ bl. at 3s. per bl.		10	6
Wheat	2½	15 bl.	1½ bl. at 25s. per bl.	1	17	6
William Britt, Thurles						
(1828)						
Wheat	1½	9 bl.	18 st. at 15d. per st.	1	2	6
Potatoes	½	30 bl.	3 bl. at 3s. per bl.		9	0
do. (1829)						
Wheat	½	2 bl.	4 st. at 15d. per st.		5	0
Potatoes	1	60 bl.	6 bl. at 5s. per bl.	1	10	0
do. (1830)						
Wheat	½	3 bl.	6 st. at 15d. per st.		7	6
Potatoes	1¼	75 bl.	7½ bl. at 3s. per bl.	1	2	6
Barley	½	80 st.	8 st. at 10d. per st.		6	8
SETTLED Ptk. Dwyer.						

* Endorsed in pencil "Thurles Old Tithe Book." The Book is numbered 164 in the Land Commission series. See Intro. Note, p. 252.

See p. 337 for list of abbreviations and table equalising fractions of an acre.

Name, Address and Year		Acreage (Irish Measure)	Produce	Tithes	£	s.	.
17.							
Micheal Finn, Thurles							
	(1829) Wheat	5½	22 bl.	2 bl. and 4 st. at 15d. per st.	2	15	0
	Potatoes	2½	150 bl.	15 bl. at 5s. per bl.	3	15	0
	Barley	¾	7½ bl.	12 st. at 10d. per st.		10	0
do.	(1830) Wheat	3¼	18 bl.	36 st. at 15d. per st.	2	5	0
	Potatoes	4½	180 bl.	18 bl. at 3s. per bl.	2	14	0
	Oats	1¼	12½ bl.	17½ st. at 9d. per st.		13	1½
SETTLED.							
18.							
Michl. & Danl. Hickey, Thurles							
	(1829) Wheat	¼	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	1 1/8	60 bl.	6 bl. at 5s. per bl	1	10	0
	Barley	1	12 bl.	19 st. at 10d. per st.		15	10
	Meadow	1	2 tn.	4 cwt. at 2s. per cwt.		8	0
do.	(1830) Wheat	7/8	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	7/8	60 bl.	6 bl. at 3s. per bl.		18	0
	Barley	¾	10 bl.	1 bl. at 13s. per bl.		13	0
Edmond Colmon, Thurles							
	(1828) Wheat	3/8	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	¼	15 bl.	36 st. at 3s. per bl.		4	6
do.	(1829) Wheat	3/8	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	3/8	20 bl.	2 bl. at 5s. per bl.		10	0
do.	(1830) Wheat	3/8	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	3/8	20 bl.	2 bl. at 3s. per bl.		6	0
SETTLED.							
No. 19.							
Michl. Heays, Thurles							
	(1828) Wheat	7/16	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	7/16	20 bl.	2 bl. at 3s. per bl.		6	0
do.	(1829) Wheat	7/16	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	7/16	20 bl.	2 bl. at 5s. per bl.		10	0
do.	(1830) Wheat	1	5 bl.	10 st. at 15d. per st.		12	6
SETTLED.							

Name, Address and Year		Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
Thomas Shaw &	Shaw Widow (1828)						
	Wheat	1 3/8	9 bl.	18 st. at 15d. per st.	1	2	6
	Potatoes	1	60 bl.	6 bl. at 3s. per bl.		18	0
	Meadow	2½	9 tn.	18 cwt. at 2s. per cwt.	1	16	0
do.	(1829)						
	Wheat	1	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	1½	90 bl.	9 bl. at 5s. per bl.	2	5	0
	Meadow	1¼	3 tn.	6 cwt. at 2s. per cwt.		12	0
do.	(1830)						
	Wheat	1¾	10 bl.	1 bl. at 25s. per bl.	1	5	0
	Potatoes	1	60 bl.	6 bl. at 3s. per bl.		18	0
	Meadow	2	6 tn.	12 cwt. at 2s. per cwt.	1	4	0
	SETT	LED, Ptk.	Dwyer.				
No. 20.							
Andrew Holohan, Thurles	(1828)						
	Wheat	1	8 bl.	16 st. at 15d. per st.	1	0	0
	Potatoes	3/8	20 bl.	2 bl. at 3s. per bl.		6	0
do.	(1829)						
	Wheat	3/8	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	1	60 bl.	6 bl. at 5s. per bl.	1	10	0
do.	(1830)						
	Wheat	1 1/8	7 bl.	14 st at 15d. per st.		17	6
	Potatoes	3/8	20 bl.	2 bl. at 3s. per bl.		6	0
No. 21.							
Michael Cunningham, Lisnaganogue.	(1828).						
	Wheat	1½	7 bl.	14 st. at 15d. per st.		17	6
	Potatoes	1½	70 bl.	7 bl. at 3s. per bl.	1	1	0
do.	(1829)						
	Wheat	1½	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	1½	60 bl.	6 bl. at 5s. per bl.	1	10	0
do.	(1830)						
	Wheat	1½	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1½	60 bl.	6 bl. at 3s. per bl.		18	0
No. 22.							
Mary Ryan, Widow, Cormickstown.	(1828).						
	Potatoes	1¼	50 bl.	5 bl. at 3s. per bl.		15	0
do.	(1829)						
	Wheat	1¼	5 bl.	10 st. at 15d. per st.		12	6
No. 23.							
John Sweeney, Loughmore	(1829)						
	Wheat	1¾	8 bl.	16 st. at 15d. per st.	1	0	0
	Potatoes	1¾	80 bl.	8 bl. at 5s. per bl.	2	0	0
do.	(1830)						
	Wheat	1½	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1½	60 bl.	6 bl. at 3s. per bl.		18	0

Name, Address and Year		Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
No. 24.							
James Mires, Kilrush							
	(1828)						
	Wheat	1¼	6 bl.	12 st. at 15d per st.		15	0
	Potatoes	1¾	80 bl	8 bl. at 3s. per bl.	1	4	0
	Oats	1	110 st.	11 st. at 9d. per st.		8	3
do.	(1829)						
	Wheat	1¼	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	1¼	80 bl.	8 bls. at 5s. per bl	2	0	0
	Oats	1	170 st.	17 st. at 9d per st.		12	9
do.	(1830)						
	Wheat	1	5 bl.	10 st. at 15d per st.		12	6
	Potatoes	1½	60 bl.	6 bl. at 3s. per bl.		18	0
No. 25.							
Patk. Ryan, Cormickstown							
	(1828)						
	Potatoes	½	30 bl.	3 bl at 3s. per bl.		9	0
	Oats	½	56 st.	5½ st. at 10d. per st.		4	7
	Meadow	½	40 Hd.	4 Hd. at 2s. per " Hundred."		8	0
do.	(1829)						
	Wheat	½	40 st.	4 st. at 15d. per st.		5	0
	Meadow	½	20 Hd.	2 Hd. at 2s. per Hd		4	0
do.	(1830)						
	Wheat	¾	5 bl.	10 st. at 15d. per st		12	6
	Potatoes	5	250 bl.	25 bl. at 3s. per bl.	3	15	0
SETTLED.							
No. 26.							
James Hieffernan, Thurles							
	(1829)						
	Wheat	1 5/8	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1½	90 bl.	9 bl. at 5s. per bl.	2	5	0
do.	•(1830)						
	Wheat	1 9/16	10 bl.	20 st. at 15d. per st.	1	5	0
	Potatoes	1¾	100 bl.	10 bl. at 3s. per bl.	1	10	0
No. 27.							
Connor Callinan, Britas							
	(1829)						
	Wheat	5¼	26 bl.	52 st. at 15d. per st.	3	5	0
	Potatoes	5¼	300 bl.	30 bl. at 5s. per bl.	7	10	0
do.	(1830)						
	Wheat	5	30 bl.	3 bl. at 25s. per bl.	3	15	0
	Potatoes	4½	180 bl.	18 bl. at 3s. per bl.	2	14	0
	Meadow	½	20 Hd.	2 hd. at 2s. per hd.		4	0
SETTLED.							

Name, Address and Year		Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
No. 28.							
Patk Quirk and Michl. Quirk, Britas.	(1828)						
	Wheat	4½	22 bl.	44 st. at 15d. per st.	2	15	0
	Potatoes	6	300 bl.	30 bl. at 3s. per bl.	4	10	0
do.	(1829)						
	Wheat	6	18 bl.	36 st. at 15d. per st.	2	5	0
	Potatoes	4½	180 bl.	18 bl. at 5s. per bl.	4	10	0
do.	(1830)						
	Wheat	4½	22 bl.	44 st. at 15d. per st.	2	15	0
	Potatoes	5½	220 bl.	22 bl. at 3s. per bl.	3	6	0
No. 29.							
Michael Ryan, Britas							
	(1828)						
	Wheat	¾	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	1¼	70 bl.	7 bl. at 3s. per bl.	1	1	0
do.	(1829)						
	Wheat	1¼	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	¾	50 bl.	5 bl. at 5s. per bl.	1	5	0
do.	(1830)						
	Wheat	¾	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1	50 bl.	5 bl. at 3s. per bl.		15	0
No. 30.							
John Mullany, Ballaunbrack							
	(1829)						
	Wheat	3	15 bl.	30 st. at 15d. per st.	1	17	6
	Potatoes	3	150 bl.	15 bl. at 5s. per bl.	3	15	0
do.	(1830)						
	Wheat	3	15 bl.	30 st. at 15d. per st.	1	17	6
	Potatoes	3	120 bl.	12 bl. at 3s. per bl.	1	16	0
SETTLED.							
No. 34.							
Tim Maher, Ardbane							
	(1828)						
	Wheat	3	18 bl.	36 st. at 15d. per st.	2	5	0
	Potatoes	2	100 bl.	10 bl. at 3s. per bl.	1	10	0
do.	(1829)						
	Wheat	1¾	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	2½	60 bl.	6 bl. at 5s. per bl.	1	10	0
do.	(1830)						
	Wheat	2½	9 bl.	18 st. at 15d. per st.	1	2	6
	Potatoes	2½	120 bl.	12 bl. at 3s. per bl.	1	16	0

Name, Address and Year		Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
No. 35.							
Michael Cormick, Kilrush	(1828)						
	Wheat	1	5 bl	10 st at 15d. per st.		12	6
	Potatoes	¾	40 bl	4 bl. at 3s. per bl.		12	0
do.	(1829)						
	Wheat	15/16	4 bl.	8 st. at 15d. per st.		10	0
	Potatoes	15/16	50 bl.	5 bl. at 5s. per bl.	1	5	0
do.	(1830)						
	Wheat	1	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	1	40 bl	4 bl. at 3s per bl.		12	0
John Maher, Ballydavid	(1828)						
	Wheat	7/8	5 bl.	10 st. at 15d per st.		12	6
	Potatoes	1	50 bl.	5 bl. at 3s. per bl.		15	0
do.	(1829)						
	Wheat	¾	4 bl	8 st at 15d. per st		10	0
	Potatoes	1	60 bl	6 bl at 5s. per bl	1	10	0
do.	(1830)						
	Wheat	1¼	6 bl.	12 st at 15d per st.		15	0
	Potatoes	¾	40 bl	4 bl. at 3s per bl		12	0
SETTLED.							
No. 36.							
John Purcell, Killrush	(1828)						
	Wheat	1	5 bl	10 st. at 15d. per st		12	6
	Potatoes	¾	40 bl	4 bl. at 3s. per bl.		12	0
do.	(1829)						
	Wheat	¼	4 bl.	8 st. at 15d. per st.		10	0
	Potatoes	¾	30 bl	3 bl at 5s. per bl		15	0
do.	(1830)						
	Wheat	1	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	1	30 bl	3 bl. at 3s. per bl		9	0
No. 37.							
Conner Molloney, Bakestown	(1828)						
	Wheat	1	5 bl.	10 st. at 15d. per st.		12	6
	Potatoes	1	50 bl.	5 bl. at 3s per bl		15	0
	Oats	¼	28 st.	2½ st. at 9d per st.		1	10½
SETTLED, 7th Decr. 1830.							
No. 38.							
Thomas Kerwick, Killrush.	(1828)						
	Wheat	1¼	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1¼	60 bl.	6 bl. at 3s. per bl.		18	0
	Oats	¼	2 bl.	2 st. 10 lb. at 9d per st.		2	0
do.	(1829)						
	Wheat	1¼	5 bl.	10 st. at 15d. per st		12	6
	Potatoes	1½	90 bl.	9 bl. at 5s. per bl.	2	5	0
	Oats	¼	3 bl.	4 st. at 9d. per st.		3	0
do.	(1830)						
	Wheat	1½	7 bl.	14 st. at 15d. per st.		17	6
	Potatoes	1½	57 bl.	7½ bl. at 3s. per bl.	1	2	6
	Oats	½	60 st.	6 st. at 10d. per st.		5	0

Name, Address and Year		Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
No. 39.							
John Kerwick, Killrush							
	(1828)						
	Oats	¼	30 st.	3 st. at 9d. per st.		2	3
	Potatoes	1	50 bl.	5 bl. at 3s. per bl.		15	0
do.	(1829)						
	Wheat	½	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	¾	45 bl.	4½ bl. at 5s. per bl.	1	2	6
do.	(1830)						
	Wheat	¾	4½ bl.	9 st. at 15d. per st.		11	3
	Potatoes	½	25 bl.	2½bl. at 3s. per bl.		7	6
	Oats	¾	105 st.	10½ st. at 9d. per st.		7	10½
No. 40.							
Thomas Maher, Killrush							
	(1828)						
	Wheat	1½	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1¾	70 bl.	7 bl. at 3s. per bl.	1	1	0
do.	(1829)						
	Wheat	1½	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1½	60 bl.	6 bl. at 5s. per bl.	1	10	0
	Oats	¼	30 st.	3 st. at 9d. per st.		2	3
do.	(1830)						
	Wheat	1½	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1½	60 bl.	6 bl. at 3s. per bl.		18	0
No. 41.							
Michael Kerwick, Killrush							
	(1828)						
	Wheat	½	2½ bl.	5 st. at 15d. per st.		6	3
	Potatoes	1	50 bl.	5 bl. at 3s. per bl.		15	0
	Oats	¾	5 bl.	7 st. at 9d. per st.		5	3
do.	(1829)						
	Oats	1¼	10 bl.	1 bl. at 10s. 6d. per bl.		10	6
	Potatoes	1¼	80 bl.	8 bl. at 5s. per bl.	2	0	0
do.	(1830)						
	Wheat	1 1/8	6 bl.	12 st. at 15d. per st.		15	0
	Potatoes	1 1/8	50 bl.	5 bl. at 3s. per bl.		15	0
	Oats	½	80 st.	8 st. at 9d. per st.		6	0
SETTLED.							
No. 42.							
John Newman, Thurles							
	(1828)						
	Potatoes	1	50 bl.	5 bl. at 3s. per bl.		15	0
do.	(1829)						
	Wheat	½	2 bl.	4 st. at 15d. per st.		5	0
	Potatoes	½	20 bl.	2 bl. at 5s. per bl.		10	0
do.	(1830)						
	Wheat	½	3 bl.	6 st. at 15d. per st.		7	6
	Potatoes	½	30 bl.	3 bl. at 3s. per bl.		9	0

Name, Address and Year	Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
No. 43.						
William Maher, Strawadavoher, Thurles. (1829)						
Wheat	1 1/8	6 bl.	12 st. at 15d. per st.		15	0
Potatoes	13/16	60 bl.	6 bl. at 5s. per bl.	1	10	0
do. (1830)						
Wheat	7/8	6 bl.	12 st. at 15d. per st.		15	0
Potatoes	1 1/8	70 bl.	7 bl. at 3s. per bl.	1	1	0
No. 44.						
Mary Ryan, Widow, Strawadavoher, Thurles (1829)						
Wheat	1½	8 bl.	16 st. at 15d. per st.	1	0	0
Potatoes	1	60 bl.	6 bl. at 5s. per bl.	1	10	0
do. (1830)						
Wheat	½	3 bl.	6 st. at 15d. per st.		7	6
Potatoes	2	120 bl.	12 bl. at 3s. per bl.	1	16	0
No. 45.						
James Butler and Dannuel Collins Strawadavoher, Thurles. (1829)						
Wheat	½	2 bl.	4 st. at 15d. per st.		5	0
Potatoes	1¾	100 bl.	10 bl. at 5s. per bl.	2	10	0
do. (1830)						
Wheat	1½	9 bl.	18 st. at 15d. per st.	1	2	6
Potatoes	5/8	40 bl.	4 bl. at 3s. per bl.		12	0
No. 46.						
Michl. Quinlan, New Road, Thurles. (1828)						
Wheat	¾	4 bl.	8 st. at 15d. per st.		10	0
Potatoes	1	50 bl.	5 bl. at 3s. per bl.		15	0
do. (1829)						
Wheat	7/8	2 bl.	4 st. at 15d. per st.		5	0
Potatoes	1	40 bl.	4 bl. at 5s. per bl.	1	0	0
do. (1830)						
Wheat	11/16	3 bl.	6 st. at 15d. per st.		7	6
Potatoes	11/16	30 bl.	3 bl. at 3s. per bl.		9	0
SETTLED.						
No. 47.						
Margrett Loughnane, Thurles, Widow. (1828)						
Potatoes	1¾	80 bl.	8 bl. at 3s. per bl.	1	4	0
do. (1829)						
Wheat	1	4 bl.	8 st. at 15d. per st.		10	0
do. (1830)						
Barley	15/16	10 bl.	1 bl. at 13s. per bl.		13	0
Potatoes	15/16	80 bl.	8 bl. at 3s. per bl.	1	4	0

Name, Address and Year	Acreage (Irish Measure)	Produce	Tithes	£	s.	d.
James, Richard and Martin Fogarty. Pike Road, Thurles. (1829)						
Wheat	1¾	6 bl.	12 st. at 15d. per st.		15	0
Potatoes	4	240 bl.	24 bl. at 5s. per bl.	6	0	0
Meadow	¾	30 Hd.	3 Hd. at 2s. per "Hundred."		6	0
SETTLED.						
Richard Fogarty, Pike Road, Thurles. (1830)						
Wheat	2½	15 bl.	30 st. at 15d. per st.	1	17	6
Barley	½	5 bl.	8 st. at 9d. per st.		6	0
Potatoes	1	60 bl.	6 bl. at 3s. per bl.		18	0
SETTLED.						
James and Martin Fogarty. Pike Road, Thurles. (1830)						
Wheat	1	6 bl.	12 st. at 15d. per st.		15	0
Potatoes	13/16	60 bl.	6 bl. at 3s. per bl.		18	0
Meadow	¾	30 Hd.	3 Hd. at 2s. per Hd.		6	0
SETTLED.						
No. 48.						
Laurence Fogarty, Commons, Thurles. (1828)						
Wheat	1½	8 bl	16 st at 15d. per st.	1	0	0
Potatoes	1¾	100 bl.	10 bl. at 3s. per bl.	1	10	0
Oats	1¼	12 bl.	16 st. 10 lb. at 9d. per st.		12	6
do. (1829)						
Wheat	1½	5 bl.	10 st at 15d. per st.		12	6
Potatoes	2	100 bl.	10 bl. at 5s. per bl.	2	10	0
Oats	1¼	12 bl.	16st. 10lb. at 9d. per st.		12	6
do. (1830)						
Wheat	1¾	10 bl.	1 bl. at £1 5s. per bl.	1	5	0
Potatoes	1½	60 bl.	6 bl. at 3s. per bl.		18	0
No. 49.						
Michael Ryan, Lisnaganogue. (1828)						
Wheat	1¾	8 bl.	16 st. at 15d. per st.	1	0	0
Potatoes	5/8	30 bl.	3 bl. at 3s. per bl.		9	0
do. (1829)						
Wheat	1¾	8 bl.	16 st. at 15d. per st.	1	0	0
Potatoes	1	40 bl.	4 bl. at 5s. per bl.	1	0	0
do. (1830)						
Wheat	1	5 bl.	10st. at 15d. per st.		12	6
Potatoes	1½	60 bl.	6 bl. at 3s. per bl.		18	0

THURLES—OLD TITHE BOOK.

FRACTIONS OF AN ACRE EQUALISED :—

IRISH MEASURE.

		A.	R.	P.			A.	R.	P.
$\frac{3}{8}$	=	—	1	20	$\frac{15}{16}$	=	—	3	30
$\frac{7}{16}$	=	—	1	30	$1\frac{1}{8}$	=	1	0	20
$\frac{5}{8}$	=	—	2	20	$1\frac{1}{4}$	=	1	1	20
$\frac{11}{16}$	=	—	2	30	$1\frac{9}{16}$	=	1	2	10
$\frac{13}{16}$	=	—	3	10	$1\frac{5}{8}$	=	1	2	20
$\frac{7}{8}$	=	—	3	20					

ABBREVIATIONS.

bl.	=	barrel.
st.	=	stone.
tn.	=	ton.
hd.	=	hundred.

TITHE APPLOTMENT RETURNS

APPENDICES

A. Proportions of Tithe to Valuation.

B.—Average prices of Wheat and Oats—1814—1830.

C.—Irish and Statute Land Measures.

D.—Summary of Agricultural Returns for the six parishes.

APPENDIX A.

PROPORTION OF TITHE TO VALUATION WITH AVERAGE RATE OF COMPOSITION PER IRISH AND STATUTE ACRES.

	Area Applotted		Valuation of Parish			Tithe Composition (Lay & Ecclesiastical)			Proportion of Total Tithe to Valuations (approx.)	Average Tithe (per acre)			
	Irish Measure	Statute Measure								Irish Measure		Statute Measure	
			£	s.	d.	£	s.	d.		s.	d.	s.	d.
Carrick-on-Suir	1246¼	2018	3788	5	0	193	16	11	1/20	3	1	1	11
Kilmurry	4637¾	7513	5982	3	9	504	18	11	1/12	2	2	1	4
Kilsheelan	4781¼	7745	4643	14	7	373	4	3	1/12	1	6¾		10
Kilcash	2349¾	3807	1791	12	6	113	17	3	1/16		11½		7
Kiltegan	615	996	1906	7	6	93	13	10	1/20	3	0½	1	10
Derrygrath	2341½	3793	4694	18	9	230	6	0	1/20	1	11½	1	2
	15968	25864	22807	2	1	1509	17	2	1/15	2	4	1	3

APPENDIX B.

NO. 1

AVERAGE PRICE OF WHEAT AS ADVERTISED IN THE "DUBLIN GAZETTE" FOR THE SEVEN YEARS ENDING 1st NOVEMBER, 1821.*

Wheat per Barrel of 20 stones.	s.	d.
1814, November 1st, to 1815, November 1st	34	2
1815, ,, ,, 1816, ,, ,,	39	7
1816, ,, ,, 1817, ,, ,,	43	0¾
1817, ,, ,, 1818, ,, ,,	49	1
1818, ,, ,, 1819, ,, ,,	42	7¼
1819, ,, ,, 1820, ,, ,,	34	6¾
1820, ,, ,, 1821, ,, ,,	27	6¼
	270	7
Average Price for seven years	38	7¾

NO. 2

AVERAGE PRICE OF OATS AS ADVERTISED IN THE "DUBLIN GAZETTE" FOR THE SEVEN YEARS ENDING 1st NOVEMBER, 1821.

Oats per Barrel of 14 stones.	s.	d.
1814, November 1st, to 1815, November 1st.	13	5¼
1815, ,, ,, 1816, ,, ,,	12	1½
1816, ,, ,, 1817, ,, ,,	21	9¾
1817, ,, ,, 1818, ,, ,,	18	2¾
1818, ,, ,, 1819, ,, ,,	16	4
1819, ,, ,, 1820, ,, ,,	13	7¾
1820, ,, ,, 1821, ,, ,,	10	8
	106	3
Average Price for seven years	15	2

NO. 3

AVERAGE PRICE OF WHEAT AS ADVERTISED IN THE "DUBLIN GAZETTE" FOR THE SEVEN YEARS ENDING 1st NOVEMBER 1830.

Wheat per Barrel of 20 stones.	s.	d.
1823, November 1st, to 1824, November 1st.	30	4½
1824, ,, ,, 1825, ,, ,,	34	5¾
1825, ,, ,, 1826, ,, ,,	33	0¼
1826, ,, ,, 1827, ,, ,,	31	2
1827, ,, ,, 1828, ,, ,,	27	7½
1828, ,, ,, 1829, ,, ,,	34	7½
1829, ,, ,, 1830, ,, ,,	32	11¼
	224	2¾
Average Price for seven years	32	0½

*See pp. 240 & 241 "The Law Relating to Variation of Tithe Rent Charges" by *D. S. Chaytor, K.C.*, Dublin.

APPENDIX B.—*Continued.*

NO. 4

AVERAGE PRICE OF OATS AS ADVERTISED IN THE "DUBLIN GAZETTE" FOR THE SEVEN YEARS ENDING 1st NOVEMBER, 1830.

Oats per Barrel of 14 stones.	s.	d.
1823, November 1st, to 1824, November 1st.	12	8½
1824, „ „ 1825, „ „	12	2¾
1825, „ „ 1826, „ „	13	7
1826, „ „ 1827, „ „	15	5¼
1827, „ „ 1828, „ „	11	0¼
1828, „ „ 1829, „ „	12	5
1829 „ „ 1830, „ „	13	6¼
	90	11
Average Price for seven years	12	11¾

APPENDIX C.

STATUTE AND IRISH LAND MEASURES.*

Irish Measure reduced to Statute 1 Acre Irish equals 1.619835 Statute.						Comparative Values of Irish and Statute Land Measures.					
Irish			Statute			Irish			Statute		
A.	R.	P.	A.	R.	P.	£	s.	d.	£	s.	d.
0	0	1	0	0	1.6	0	0	6	0	0	3¾
0	0	2	0	0	3.2	0	1	0	0	0	7½
0	0	3	0	0	4.9	0	2	0	0	1	2¾
0	0	4	0	0	6.5	0	3	0	0	1	10¼
0	0	5	0	0	8.1	0	4	0	0	2	5½
0	0	6	0	0	9.7	0	5	0	0	3	1
0	0	7	0	0	11.3	0	6	0	0	3	8½
0	0	8	0	0	13.	0	7	0	0	4	3¾
0	0	9	0	0	14.6	0	8	0	0	4	11¼
0	0	10	0	0	16.2	0	9	0	0	5	6¾
0	0	20	0	0	32.4	0	10	0	0	6	2
0	0	30	0	1	8.6	0	12	6	0	7	8½
0	1	0	0	1	24.8	0	15	0	0	9	3
0	2	0	0	3	9.6	0	17	6	0	10	9¾
0	3	0	1	0	34.4	1	0	0	0	12	4¼
1	0	0	1	2	19.2	1	2	6	0	13	10¾
2	0	0	3	0	38.3	1	5	0	0	15	5¼
3	0	0	4	3	17.5	1	7	6	0	16	11¾
4	0	0	6	1	36.7	1	10	0	0	18	6¼
5	0	0	8	0	15.9	1	12	6	1	0	0¾
6	0	0	9	2	35.	1	15	0	1	1	7¼
7	0	0	11	1	14.2	1	17	6	1	3	1¾
8	0	0	12	3	33.4	2	0	0	1	4	8¼
9	0	0	14	2	12.6	2	5	0	1	7	9½
10	0	0	16	0	31.7	2	10	0	1	10	10½
20	0	0	32	1	23.5	2	15	0	1	13	11½
30	0	0	48	2	15.2	3	0	0	1	17	0½
40	0	0	64	3	6.9	4	0	0	2	9	4¾
50	0	0	80	3	38.7	5	0	0	3	1	8¾
60	0	0	97	0	30.4	6	0	0	3	14	1
70	0	0	113	1	22.1	7	0	0	4	6	5½
80	0	0	129	2	13.9	8	0	0	4	18	9½
90	0	0	145	3	5.6	9	0	0	5	11	1¾
100	0	0	161	3	37.4	10	0	0	6	3	5½
200	0	0	323	3	24.7	20	0	0	12	6	11¼
300	0	0	485	3	32.1	30	0	0	18	10	5
400	0	0	647	3	29.4	40	0	0	24	13	10½
500	0	0	809	3	26.8	50	0	0	30	17	4
600	0	0	971	3	24.1	60	0	0	37	0	9¾
700	0	0	1,133	3	21.5	70	0	0	43	4	3½
800	0	0	1,295	3	18.8	80	0	0	49	7	9
900	0	0	1,457	3	16.2	90	0	0	55	11	2¼
1,000	0	0	1,619	3	13.6	100	0	0	61	14	8¼

*(From *Thom's Directory*).

APPENDIX D.

SUMMARY OF AGRICULTURAL RETURNS FOR SIX PARISHES.

ACRES—STATUTE MEASURE.

	Potatoes	Wheat	Oats	Barley	Pasture	Fallow	Other Land	Total Area
Carrick-on-Suir	421	321	187	19	977	4	89	2018
Kilmurry	1643	1376	704	—	3368	26	396	7513
Kilsheelan	1203	961	305	—	2225	—	3051	7745
Kilcash ..	796	330	558	—	1236	4	883	3807
Kiltegan	145	185	72	17	537	—	40	996
Derrygrath	732	964	458	185	936	178	340	3793
	4940	4137	2284	221	9279	212	4799	25872
Per cent	19.09	15.99	8.83	0.86	35.86	0.82	18.55	

OBSERVATIONS ON BLACK CURRANT VARIETIES GROWN AT ALBERT AGRICULTURAL COLLEGE, GLASNEVIN.

by

PROFESSOR G. O. SHERRARD.

The factors which control the cropping of fruit trees or bushes are both numerous and complicated and make it very difficult to assess the ecomomic prospect of a plantation even assuming that the price obtained for the fruit should remain constant. And yet in order to convince a prospective grower that planting is worth while one must be prepared to give him some figure which will represent the probable average return from the plantation over a series of years. The main factors affecting cropping are nutrition, the incidence of disease or pest, the season and the variety. These are often inter related as when a wet season favours fungus disease or a dry one insect attack, or a variety may be resistant or susceptible to a certain insect or fungus. The season is outside the grower ' control, all he can do with regard to it is to choose a piece of ground for the plantation as little subject as possible to spring frosts and sheltered from high winds. The other factors, however, can be to a great extent controlled by the grower. The varietal factor is an extremely important one in the case of tree and bush fruits which take some years to reach a state of economic cropping, years which are lost should the variety turn out to be a bad one. In the case of black currants it will be seen from the figures given below that varieties may differ in their yield by as much as 40 per cent. over a series of years which represents a considerable loss to the grower should he plant a low yielding variety.

Variety trials of the tree or of bush fruits take a long time to carry out and probably for this reason have not been often attempted. The black currant varieties have however been more studied than most small fruits. The botanical differences between them were first pointed out by Hatton in 1912, who also showed that setting depended to some extent on the relative position of the stigma and stamens. He found that the variety Baldwin in which the stigmatic surface is very close to the stamens set better under unfavourable spring conditions than Boskoop Giant in which the stigma protrudes considerably beyond them. The bunch or raceme with only one or two fruits on it is a common sight after a bad spring and this condition s called ' running off ', it is certainly more prevalent in some varieties than in others. Fortunately in Ireland ' running off ' is less severe than in England owing to our milder springs. If, as is shown to be the case, varieties differ considerably in their yields then the recognition of a variety becomes very important and Hatton's division of the black currants into groups has been of great value. In this connection I remember an old gentleman in Co. Kilkenny pointing out to me with great pride a plot of Boskoop

Giant, the fruit of which for many years past had taken 1st Prize at Kilkenny Show. He was very surprised to learn that the variety was not Boskoop Giant but Goliath. The variety trials conducted by the Royal Horticultural Society of England in co-operation with the British Ministry of Agriculture have yielded useful information with regard to the relative merits of the different varieties, and the Long Ashton trial has produced accurate figures for the yields of the varieties over a seven year period under Long Ashton conditions.

The Glasnevin trial was planted in February 1929 with material obtained from East Malling and from Greenmount Agricultural College, Co. Antrim. The soil at Glasnevin is a clay loam with about 30 per cent. of clay particles and a pH of 7.0—7.5. It is a heavy deep soil on a boulder clay formation and grows black currants fairly well. The bushes which were mostly 1 year old were planted in plots of six in the same lines as maiden apples and at 4 feet apart. The distance between the apples was sixteen feet and the combined lines of apples and black currants were sixteen feet apart the space between being cropped with vegetables. The plots were not randomised so that the figures obtained cannot be subjected to statistical analysis but it was arranged that the same variety should occupy a different position in each line. The ground received a dressing of farmyard manure before planting and the bushes were given an annual dressing of the same material with 2 cwt. of sulphate of potash every third year. No pruning was given until the sixth winter after planting when crop recording was discontinued.

Black Currant Mite appeared on a few bushes early in the trial but was controlled effectively by one spraying with Lime Sulphur 1 in 15, given annually when the blossom truss became visible on the shoot Under this treatment not only did the Mite fail to spread but the affected bushes became clean of the pest. A few bushes reverted, eighteen in all, and these included twelve of one variety which there is little doubt had the virus in it when purchased. An annual winter spray of tar oil wash kept the bushes practically clear of aphis during the trial. Leaf Spot, *Pseudopeziza Ribis* Kleb, was prevalent in 1930 and in 1932. The virulence of this disease largely depended on the season, but some varieties are more susceptible than others, at one end of the scale is the highly susceptible Baldwin at the other the resistant Goliath. Spraying was not carried out against the disease at Glasnevin, but in bad years there is no doubt that Baldwin would require to be sprayed, copper sprays are said to be quite effective.

Besides the varieties given in Table I a number of other kinds were grown, but not in sufficient quantity to make their cropping figures significant—about a dozen bushes of each. It was possible to say however by inspection and weighing of the produce whether the variety would be worth a more critical examination. The other varieties were—Westwick, Choice Raven, Black Grape, Tinker, Mite Free and Blacksmith; a group of Canadian varieties—

Topsy, Eagle, Saunders Clipper, Magnus and Kerry, and two old Irish varieties one of which was collected at Ballyhaise Agricultural Station, Co. Cavan and the other in a garden in Co. Cork.

Messrs. Lamb Bros. (Dublin) Ltd. very kindly tested the jam making qualities of some of the varieties in 1935 and 1936. The jams differed in colour, flavour and consistency according to the variety used. Messrs. Lamb also considered that a difference could be observed in the flavour of the same variety when it was manured with different fertilisers. In their opinion none of the currants grown at Glasnevin made quite such good jam as a variety they imported from France which had coloured flesh. This variety appears to be distinct from the varieties French and Gironde grown at Glasnevin although these are supposed to have originated in France, these varieties have green flesh. The variety named French, however, made the best jam of the Glasnevin varieties, but is unfortunately a very poor cropper. Seabrook's Black and Baldwin made good jam, Boskoop Giant fair but Goliath a jam of poor quality both in colour and flavour. An old variety collected in Co. Cork made quite good jam, in fact came second to French. It is unfortunate that Goliath which was the heaviest cropping variety in the trial made the worst jam, but the difficulty could be got over by blending it with other kinds. The difference in the jam making qualities of the varieties and the effect of fertilisers on jam flavour is interesting and appears to be worth further investigation.

It will be seen from the tables that Goliath gave the heaviest yield—5.51 lbs. per bush, taking the average of all stations. At Glasnevin this variety did particularly well (7.43 lbs. per bush or 4.012 tons per acre) it also gave a very high yield (6.34 lbs. per bush) at Merton where the soil, like that of Glasnevin, is of heavy texture. My colleague Mr. F. Hussey kindly examined statistically the yield data of this variety for the three years 1932-34 at Glasnevin. He reported " On the basis of the three years' average Goliath was significantly superior in yield to the other five varieties. When the figures for each year were examined it was found that this superiority was maintained for each of the three years in comparison with each of the three varieties Seabrook, Baldwin and French. Goliath was a significantly heavier yielder than Boskoop Giant in 1933 and its superiority in 1934 was very close to statistical significance. The higher yield obtained over Boskoop Giant in 1932 was not, however, sufficient for significance.

There was little difference in yield between Seabrook's Black and Boskoop Giant except at Wisley where the soil is very sandy. Mr. Hussey reported of Seabrook's Black at Glasnevin—" This variety gave an average yield practically the same as that of Boskoop Giant over the three years (1932-34). Though giving a markedly lower yield in 1932 and a slightly lower one in 1934, in 1933 it returned a significantly higher yield than Boskoop."

Baldwin gave a high yield at Osgodby, but the figures there only cover a

four year period, at other stations the yield of this variety was rather low. Mr Hussey states " Baldwin gave a significantly lower yield on the 3 year average than Boskoop Giant. The latter was significantly better in 1934 and probably significantly better in 1932 its low yield in 1933 did not reach significance. Baldwin also gave a significantly lower yield than Seabrook in 1933 and 1934 and on the 3 years' total."

If the value of a black currant crop is taken at £40 per ton (the average price obtained for the fruit during the trial) the gross average return from the variety Goliath at Glasnevin was £27 12s. per acre per annum more than that of Seabrook's Black and £47 4s. more than that of Baldwin throughout the period of the trial. In other words over the five year period Goliath earned £138 per acre more than Seabrooks and £237 more than Baldwin.

The annual cost of growing and marketing an acre of black currants is estimated at between £45 and £55 per annum of which the most expensive item is the picking of the fruit at about £20 per acre If this can be done by family labour it will of course increase the profits. In order to insure a reasonable profit at a price of £45 a ton a crop of 2 tons per acre is requisite. This should be easy to achieve with Goliath, Boskoop Giant or Seabrook's Black over a period of at least eight years. Data are not available as to the length of the economic life of a plantation. An East Anglian grower gives it at ten years under his conditions with an average crop of 30 cwts. over the whole period the crop rising to a maximum of 4 tons in the sixth year after planting and falling to 15 cwt. in the tenth. This estimate may be compared with the yields obtained from the Cork variety at Glasnevin (Table 3).

At Glasnevin most of the varieties reached their maximum fruitfulness in the sixth summer after planting, but the Cork variety gave its highest yield in the seventh. At Wisley Goliath gave its heaviest crop in the seventh summer after planting, 4.5 tons. Boskoop Giant in the eighth (3.6 tons), and Seabrook in the sixth (3.4 tons). The black currant produces the bulk of its crop on young wood, as the bush gets older it tends to produce less young wood and at the same time carries a considerable amount of old barren wood which has accumulated since it was planted. At Glasnevin it has been the practice not to prune the bush apart from the preliminary cutting back after planting until it is judged the maximum crop is reached. Then the branches showing least young wood are cut hard back removing half of them in one year and the other half the next. In this way a fresh growth of young wood is obtained but the maximum crop is not again reached. Some growers remove a certain number of branches each year to keep the bush renewed gradually instead of adopting the more drastic method of cutting back in the fifth or sixth year. There are no data available to show which is the better method to adopt. The soil and the variety both have an effect on the length of the economic life of a plantation.

NOTES ON VARIETIES.

Goliath. A very large strong growing and spreading bush with numerous rather stout shoots and green buds faintly tinged with pink. The growth is upright at first, but as the bush grows older the branches are inclined to sag and root where they touch the ground. The leaves are large and form a dense canopy which partly shades the fruit and causes uneven ripening. Although the leaves appear to suffer more from lime sulphur spray than do those of other varieties this does not seriously affect the growth or cropping of the bush. The berries were the largest in the trial and before ripening develop a characteristic whitish green colour. Owing to the shortness of the truss they are somewhat troublesome to pick and Swarbrick and Thompson give the cost of picking a ton of this variety at £8 5s 7d. against £6 2s. 6d. for Boskoop Giant. The bunches are also said to 'strig' badly that is to say the berries do not part readily from the stalks. The variety is highly resistant to Black Currant Leaf Spot and not more subject to Black Currant Mite than other varieties. In a bad spring some "running off" will occur but less than in the case of most other varieties.

In spite of its faults this must be considered one of the best black currants for general planting on account of its great cropping power, and the attractive appearance of the berries. Victoria and Edina, which belong to the same group as Goliath, very closely resemble it and would probably approach it in cropping.

Boskoop Giant. A very large widely spreading bush rather sparsely branched. The buds are *dark red.* The growth is spreading rather than upright. The shoots are stouter than those of most other varieties except Goliath. The berries are larger than those of any varieties except those of the Goliath group and are the earliest to ripen. In a bad spring "running off" is worse than on any other variety, but seldom causes, with us, complete loss of crop as is sometimes the case in England. The variety is rather subject to Leaf Spot but less so than Baldwin. Boskoop Giant is easily recognised when in flower by the long flower truss which is held out stiffly at right angles to the stem. The fruit have rather thin skins and are said to travel badly.

This variety is perhaps more generally grown than any other in Irish gardens and seems to thrive on a large variety of soils including peats and heavy clay loams. Its earliness and the large size of the fruits make it a valuable commercial variety although in jam making qualities it is slightly inferior to Seabrook's Black or Baldwin.

Seabrook's Black. This variety makes a large dense bush, but with thinner and more numerous shoots than Boskoop Giant. The buds are red about the same colour as those of Boskoop, but much darker than the buds of Goliath. The fruits are intermediate in size between the large fruits of Boskoop Giant

and the small ones of French and are about the same size as those of Baldwin. They have tough skins, travel and hang well and are of good jam making quality. It is a mid season variety ripening between Boskoop and Goliath. It is difficult to distinguish the bushes of Seabrook's Black from those of the old variety French which is much inferior to it as a cropper and has smaller fruit, the principal difference is the rather thicker shoots and stiffer growths of Seabrooks. The variety "runs off" considerably in a cold spring, but is not quite so bad as Boskoop Giant in this respect, it is moderately susceptible to Leaf Spot.

Baldwin. At Glasnevin this variety made a smaller and more compact bush than any other in the trial. These characters together with the large pale green buds with loose scale leaves serve to distinguish it from the other kinds. It is the first to come into flower, but the latest to ripen its fruits with the exception of September Black. The berries are of medium size and very closely clustered along the shoot. Of all the varieties it is the least subject to "running off" but the most susceptible to Leaf Spot. The berries are of good jam making quality and travel well. This variety has not at Glasnevin maintained the cropping reputation it has gained in parts of England, possibly the soil is too heavy for it. On its performance here it cannot be recommended for general commercial planting. It has, however, value as a garden currant on account of the lateness of ripening and the small size of the bush which takes up considerably less space than Boskoop Giant or Goliath.

French. A medium sized much branched bush with rather thin shoots and spreading growth. Very close to Seabrook's Black in appearance but a little smaller and with more slender shoots. The buds are red, but paler than those of Boskoop Giant. Fruit small ripening just after those of Seabrook's Black it is a mid season variety. Shows much "running off" in a cold spring and is rather susceptible to Leaf Spot. It is a poor cropper but makes excellent jam. Indistinguishable from Gironde. This is not an economic variety and if the jam manufacturers require it on account of its good jam making qualities, they will have to pay more for the fruit. It does not appear to be identical with the variety imported from France by the jam manufacturers which is said to have coloured flesh, which enhances its value for jam making. The French grown at Glasnevin has green flesh.

Davisons 8. This is a mid season variety ripening between Seabrook's Black and Goliath. It makes a rather compact bush like Baldwin, with green buds and stiff growth. The berries are about as large as Seabrook's Black and densely clustered on the shoots, like those of Baldwin and Westwick Choice. It was evident from the yellowish green colour of the leaves and the unthrifty growth that the soil at Glasnevin did not suit this variety, but it might be worth trying in other soils, its fruiting habit suggests that it would crop heavily where the soil suited it. Moderately susceptible to Leaf Spot it does not "run off" severely in a cold spring.

Ballyhaise Variety. The bush is of vigorous erect growth with rather stout shoots and large red buds. The buds and shoots resemble Boskoop Giant in colour, but the habit of growth is more like Goliath. The berries are very small and of a rather dull black. They ripen early and show little "running off." The variety is very subject to Leaf Spot. The smallness of the berries renders this variety useless from the commercial point of view. It is of some interest, however, in being unlike any other variety in the trial nor does it fit into any of the four groups. Even the autumn colouring of the leaves of this variety is distinct being dull tawny orange with conspicuous red veins. Some varieties stand out in autumn on account of their distinctive coloration. Goliath changes to a clear orange yellow, Boskoop Giant and Seabrook a tawny brown and Baldwin to a dull brown with purplish tinge. The development of autumn tints depends to a considerable extent on the weather at that season.

Co. Cork Variety. A very vigorous bush with numerous rather thin shoots, a spreading habit and red buds. In growth and winter characters it resembles French and probably belongs to the same group, but makes a larger bush. The berries are intermediate in size between those of French and Seabrooks, and make an attractive market sample owing to their intense black colour and shiny skins. There is a considerable amount of "running off" in bad years. They are easy to pick and make jam of good quality. In spite of the rather small size of the fruit this is worth considering as a commercial variety on account of its cropping power, the quality of the fruit, and the robust constitution of the bush. In connection with the last quality I have seen a line of this variety in the same position for forty years still carrying crops.

Canadian Varieties. The varieties Topsy, Saunders and Magnus resembled one another in having green buds, shiny leaves and small fruit. They made large straggling much branched bushes with rather thin crowded shoots, the leaves of which tended to shade the fruit. Although these varieties each carried an average crop of about 7 lb. per bush (3½ tons per acre) during the three years 1932-1934, the small berries, about the same size as French, with dull black skins were unattractive and not such as to make them good market kinds. Topsy when tested did not make very good jam. These three varieties are obviously closely related and are distinct from any others in the trial. Eagle, Kerry, and Clipper were also green budded varieties making rather smaller bushes than the first three. Eagle had the shiny foliage characteristic of most of the Canadian varieties. All three had small fruit and gave too low yields to entitle them to consideration as commercial varieties.

Hugo Vallen was very distinct from the other Canadian kinds with red buds rather stout shoots and large fruit. The crop however was less than that of Boskoop Giant and it had no advantages over that variety which it rather resembled.

Varieties of Recent Introduction. Small numbers of bushes of varieties of recent introduction were added to the trial from time to time including Westwick

Choice, Blacksmith, Mite Free, Tinker, The Raven and Black Grape. Westwick Choice looked very promising for the first few seasons but then "reverted" and ceased to crop. It is probable that the bushes were carrying the virus when purchased.

Blacksmith, Tinker and Black Grape have such lax growth that the outer branches lie on the ground when carrying a crop with the result that the fruit is soiled and cultivation is interfered with. This character alone was sufficient to condemn them as commercial varieties. Blacksmith had large fruit but showed a good deal of "running off." The fruit of Tinker and Black Grape were of medium size. The crop was not weighed but none of these varieties looked exceptional croppers. Mite Free has berries of medium size but showed such bad "running off" for two seasons in succession that it was not considered at all promising. Raven had fairly large fruit about the size of Seabrook's and stouter wood than the lax varieties, but did not look an improvement on several of the older kinds.

Choice of Variety. The trial at Glasnevin taken in conjunction with those at English centres indicates that of the varieties tested there are only three which can be recommended for general commercial planting :—Goliath, Boskoop Giant and Seabrook's Black. Of these Goliath is the heaviest cropper and would probably be the most profitable variety to plant in most cases. Its poor jam making qualities would have to be taken into account in the planning of a plantation by a jam manufacturing firm and the advisability of planting a proportion of the area with Seabrook's Black, a good jam currant, would appear evident. The jam making qualities of a variety however have not yet influenced its price on the open market. A point in favour of planting more than one variety is that it would extend the period of picking the crop. A variety must be picked as soon as it is ripe so that if a large area of one variety is planted many pickers will be required. Boskoop Giant, Seabrook's Black, and Goliath ripen in succession in the order named with an interval of about a week between each. A plantation containing all three would be easier to pick than the same area under one or two of them.

Summary. This paper compares the cropping of certain black currant varieties at Glasnevin and at various centres in England over a period of years.

The economic value of the different varieties is discussed and the probable life of a plantation estimated.

Notes on the growth characteristics, resistance to disease and jam making qualities of the varieties are given.

My thanks are due to my assistant Mr. E. Clarke for working out the yields of the varieties and to Mr. F. Hussey for examining the figures.

TABLE 1.

CROPPING OF BLACK CURRANT VARIETTIES AT A.A.C. GLASNEVIN 1930-34.

Variety	No. of Bushes	Planted	Mean Yields per Bush lb.					Mean for 5 years	Total Yield per acre tons	Mean Annual Yield per acre (tons)
			1930	1931	1932	1933	1934			
		March								
Goliath	34	1929	1.99	2.56	9.12	9.96	13.51	7.43	20.062	4.012
Boskoop Giant	21	,,	1.32	3.32	7.85	5.49	11.74	5.94	16.043	3.208
Seabrooks'	40	,,	1.13	3.13	6.63	7.33	11.20	5.88	15.892	3.178
Davisons'	27	,,	1.56	2.19	8.88	7.69	6.81	5.43	14.655	2.931
Baldwin	43	,,	1.63	3.01	6.68	6.37	6.73	4.88	13.191	2.638
French	46	,,	1.22	1.73	4.63	4.46	9.20	4.25	11.472	2.294

The yields per acre are calculated on a spacing of 9ft x 4ft. or 1210 bushes per acre.

TABLE 2.

YIELDS AT ENGLISH CENTRES COMPARED WITH THOSE AT GLASNEVIN

	Goliath		Boskoop		Seabrooks'		Baldwin		Davisons'	
	Mean Yield Per Bush lb.	Trial Period	Mean Yield Per Bush lb.	Trial Period	Mean Yield Per Bush lb.	Trial Period	Mean Yield Per Bush lb.	Trial Period	Mean Yield Per Bush lb.	Trial Period
Long Ashton (Wisley material)			3.65	7 yrs.			3.17	7 yrs.	1.72	7 yrs.
Long Ashton (Own material) ..	3.52	7 yrs.	3.43	7 yrs.	3.89	7 yrs.	3.12	7 yrs.		
Wisley	4.86	7 yrs.	3.14	7 yrs.	4.09	7 yrs.	1.75	7 yrs.	2.76	7 yrs.
Merton ...	6.34	5 yrs.	6.86	5 yrs.	5.60	5 yrs.	3.86	5 yrs.	4.02	5 yrs.
Perdiswell	5.6	3 yrs.	4.07	3 yrs.	3.70	3 yrs.	4.63	3 yrs.	4.37	3 yrs.
Osgodby	5.3	4 yrs.	4.40	4 yrs.	5.00	4 yrs.	6.35	4 yrs.	5.43	4 yrs.
Glasnevin	7.43	5 yrs.	5.94	5 yrs.	5.86	5 yrs.	4.88	5 yrs.	5.43	5 yrs.
Average all Centres	5.51		4.50		4.69		3.96		3.92	

TABLE 3.

Co. Cork Variety

78 bushes planted 1927.

Average Yield per bush (lb.) and calculated Average Yield per acre (tons).

	1929	1930	1931	1932	1933	1934	1935
Per bush (lb.)	1.83	2.99	4.79	7.26	6.80	9.42	5.96
Per ac. (tons)	0.99	1.62	2.59	3.92	3.67	5.09	3.22

Average yield per bush over 7 year period .. 5.58 lb.

Average yield per acre ,, ,, ,, ... 3.01 tons.

REFERENCES.

Hatton, R. G.. Black Currant Varieties—A Method of Classification J. Pomol. 1 pp 65-80, 145-154.

Swarbrick, T, and Thompson, C. R. A comparison of the picking costs of Six Commercial Varieties of Black Currants. Ann. Rep. Long Ashton Agric. Hort. Res. Stat. 1934.

Roy, J. Trials of Varieties of Hardy Fruits for Commercial Purposes. Hort. Soc. 1932. 47 pp. 246-284.

Swarbrick, T. and Berry, W. E. Comparative Yields of Black Currant Varieties and their response to Differential Pruning Treatment. Ann. Rep. Long Ashton Agric. Hort. Res. Stat. 1936.

(Received for Publication on 3rd April, 1941).

PRODUCTION OF ROOT AND VEGETABLE SEEDS.

The fact that practically all our supplies of root and vegetable seeds consist in normal times of imported stocks places us in a difficult position in present circumstances. So far as the 1941 season is concerned the Seed Trade has succeeded in procuring reasonable supplies and with economy in use no shortage should be experienced. It is, however, possible that the position in regard to imports in 1942 may be less favourable and it is, therefore, now incumbent on every grower, particularly of turnips and mangels, to take steps to produce during the present season his full requirements for sowing in 1942.

Most roots and vegetables, including turnips and mangels, are biennials, or, in other words, they do not normally " bolt " or produce seed heads in the season in which the seed is sown. Accordingly in the production of root seeds on a commercial scale it is usual to sow the seed during a favourable spell of weather in July or early August. The resulting plants will have produced small bulbs or roots before the approach of Winter, after which they remain dormant until early Spring, when they are either thinned out or transplanted. The farmer who proposes to produce a limited quantity of seed for his own use can also adopt this method if he plans sufficiently far ahead. Seed might be sown in a small bed in the vegetable garden in July or August, 1941, and the necessary number of roots transplanted to a suitably prepared site in March, 1942, to produce seed in the Autumn of that year. The immediate problem is, however, to produce seed for the 1942 crop and this can be achieved only by adopting an alternative procedure, namely, by planting out this Spring, roots from the 1940 crop from which seed can be harvested next Autumn.

Suitable roots, typical of their kind, of medium size, and free from disease should be slected and planting out may begin any time after the end of February when the soil is in suitable condition. Planting of turnips or mangels should, if possible, be completed before the end of March. Normally about *fifty roots should produce sufficient seed to sow a statute acre* and farmers should make their selection of roots on this basis.

Planting and Cultivation—The plot of ground selected for the purpose should be well cultivated beforehand and well-rotted farmyard manure applied at the rate of ten to twelve tons per statute acre.

The seed stocks, or " mother-roots," as they are called, should be planted in an upright position, about 24 inches apart each way, and covered to a depth of about one inch in the case of root crops, and to the base of the main outer leaves in the case of cabbages and other green crops. Planting should be carefully done, otherwise losses due to decay of roots, and, later on, to damage by wind may occur. Each root should be carefully examined after planting in

order to ensure that it is firmly fixed in the soil. Any roots which are not securely held should have the soil well tramped around them thereby ensuring the exclusion of drying winds during late Spring and good anchorage during the seed-bearing period. It is very desirable that the plants should remain upright during the growing season as this promotes uniform development and ripening of the flowerheads which are essential to the production of a good yield of seed. It is necessary in the case of mangels to cut off the tip of the main shoot as soon as growth commences in order to encourage branching. Turnips, cabbages, etc., branch naturally. Precautions must be taken to prevent damage to the young shoots by vermin, particularly by rabbits, hares and wood-pidgeons. Birds also do considerable damage to most ripening seeds and it may be necessary to protect the seed heads with netting.

As soon as the young shoots become visible the hoe should be freely used in order to keep down weeds and to provide favourable soil conditions for vigorous growth. When the plants have reached a height of six to nine inches they should be moulded up in order to encourage the development of the flower-bearing heads and to provide better protection against strong winds. No further treatment is required until the crop is ready for harvesting except to keep the ground free from weeds and particularly to prevent from reaching the flowering stage, weeds which might hybridise with the plants from which seed is being produced.

Harvesting.—The time of ripening depends on the crop, the date of planting, and on weather conditions throughout the growing season, but normally the seed should ripen during August. *It is advisable to wait until the crop is fully ripe before commencing harvesting operations.* The seeds ripen in succession from the bottom of the seed stalk upwards, and some loss of seed is inevitable. In the case of mangels losses can be reduced if the crop is harvested when the seed clusters on the lower portions of the stalks turn brown. At this stage the majority will be fully developed.

Swedes, turnips and crops of the cabbage family are fully ripe when the pods have turned brown. To prevent losses due to shedding, harvesting operations should commence when the seed pods have reached a pale brownish colour.

Parsnips and carrots are ready for harvesting when a large proportion of the seed heads have become brown and the stems begin to bleach.

In the case of all crops the seed stalks should be separated from the root by cutting the main stem at a point well below the junction of the lowest seed-bearing stalks. They should then be tied together in bundles of three or four and stooked until the seed pods and foliage are well shrunken and seasoned—usually in about seven to ten days depending on weather conditions. Alternatively the stalks may be hung up in an open shed to dry and be kept there until they are fully matured. In the case of small plots individual seed stalks may be collected as the majority of the seeds on them ripen.

Seed crops of roots and vegetables cut at the normal stage of ripeness are extremely liable to "shed" the seed, hence handling should be reduced to the minimum. When the crop is being removed from the field, the cart used should be lined with sacking and the sheaves should be loaded on the cart from ground sheets, on which they should have been carefully placed beforehand.

Where operations are on a large scale, threshing may be done by any ordinary type of thresher, in which the necessary adjustments can be made, care being taken to prevent loss of seed in handling. Where a farmer plants merely a few dozen roots to produce his own seed requirements the seed heads may be threshed by placing them in a sack and beating lightly with a stick. The seed can be cleaned by screening with an ordinary winnower or with a hand sieve.

Root and vegetable seeds require to be carefully dried after threshing. Small quantities can be dried in the farm kitchen, but in the case of commercial quantities a drying kiln should be utilised. After drying, the seed should be stored in a cool, dry, well-ventilated place in order to prevent losses due to moulds. Small quantities may be suitably stored in canvas bags suspended from the rafters of a weatherproof outhouse

Although mangels and turnips have been referred to particularly in the foregoing, the remarks apply almost equally to carrots and parsnips as well as to cabbages, cauliflowers and other members of the same family. Seed of all these may be saved next Autumn by planting out during the coming Spring "mother" roots as already described or, in the case of cabbages, etc., selected "heads" from the past season's crop. Indeed many farmers already "save" cabbage seed by adopting this procedure.

Farmers who sowed rape as a catch crop last August can provide seed for sowing next Autumn by allowing portion of the crop to reach maturity and by saving the seed therefrom.

It should be remembered that certain plants of similar type intercross with each other. This intercrossing or "hybridisation" takes place when the parent plants are in flower and the resulting seed will produce a hybrid which may be of little value from the farmer's point of view.

As a general rule the cultivated plants in each of the following groups will only intercross amongst themselves :—

Group I—Swedes, turnips, rape.

Group II—The members of the cabbage family, that is drumhead and garden cabbage, kale, savoy, etc.

Group III—Mangel, sugar beet and garden beet.

Carrots, parsnips, parsley and celery, while not intercrossing amongst themselves, may do so with closely related wild forms, for example, cultivated carrot with wild carrot, etc.

As a safeguard against the production of impure seed the varieties in any one of the above groups should not therefore be grown in close proximity to each other. In practice it will be desirable to provide for a distance of from three to four hundred yards.

Sugar Beet Seed.—The cultivation of sugar beet seed and the supply of seed to contract growers are as heretofore being attended to by the Irish Sugar Company, Ltd., who are in a position to select the most suitable strains for the purpose and beet growers should in no circumstances use seed other than that supplied by the Company. A farmer or other private individual who attempts to grow sugar beet seed may produce a low sugar yielding strain or worse still a hybrid. The Irish Sugar Company, Ltd., would in any event decline to accept delivery of a crop from seed so produced.

(Issued as Special Leaflet No. 15, February, 1941).

ECONOMY IN THE USE OF ROOT SEEDS.

The Department's Special Leaflet No. 15 "The Production of Root and Vegetable Seeds" outlines the measures which farmers should adopt this Spring in order to provide themselves with the necessary supplies of these seeds for sowing in 1942. Meanwhile the supplies of turnip and mangel seeds available for sowing in the present season are unfortunately, considerably less than our normal requirements. The Department has requested wholesale and retail seedsmen to distribute, proportionately amongst their customers, such seeds as are available, and also to have regard to the requirements of growers, who cannot procure supplies from their usual retailers. At best, therefore, growers will be unable to procure sufficient supplies to allow the usual rate of seeding, namely, 4 to 6 lb. per statute acre of turnips and swedes, and 12 to 15 lb. of mangels. In view of the relatively small number of plants which are allowed to remain, after root crops have been "thinned" or "singled" it is obvious that these rates of seeding are needlessly heavy and that in present circumstances they should be greatly reduced. Farmers, should, therefore, adopt measures accordingly.

The first step towards such a reduction, and particularly in the case of turnips and swedes, is to provide a sufficiently fine tilth to ensure that all seeds are sown at a uniform depth, and that none are lost by sinking too deeply in a rough, badly-prepared seed bed. Provided conditions are favourable, a seeding of 2 lb. of turnips or swedes will be sufficient, and no difficulty should be experienced in adjusting the ordinary turnip sower accordingly.

A seeding of 3 to 4 lb. per statute acre should be quite sufficient for mangels but the turnip sower cannot be depended on to deal with this quantity without risk of "blanks," and hand sowing or "dibbling" will, therefore, be necessary. This may seem a slow operation but the use of a "dibble" similar to that shown in the accompanying illustration will save much time. Where this method of sowing mangels is practised, the man who operates the dibble presses his foot on it each time it is placed in position, thus providing a firm seed bed at a uniform depth. A second man or youth following immediately behind places the requisite number of seeds in each dibble hole so made, and then fills the hole by drawing in the surrounding soil with the hand. A previous light rolling of the drills will facilitate "dibbling." A light rolling immediately after dibbling will in any event *be very essential*.

In the "dibble" shown in the illustration, the "teeth" are placed ten inches apart. On rich well-manured land and particularly in the case of Globe varieties of mangels, rather than Tankard or long red types, the distance may be increased to 12 inches. This is a matter for individual growers.

Each mangel "seed" or "cluster" is really a fruit containing two or more

true seeds and an average sample of seed will usually give a germination of 140 per cent. and upwards. This means that 4 mangel "seeds" will produce 5 to 6 seedlings. Owing to lower average germination this season, not more than 5 seedlings may be expected from 4 seeds.

Farmers should beware of using inferior seed which may have been held by retailers from previous seasons, under conditions which have destroyed the germinating capacity, or at least caused a serious drop in germination.

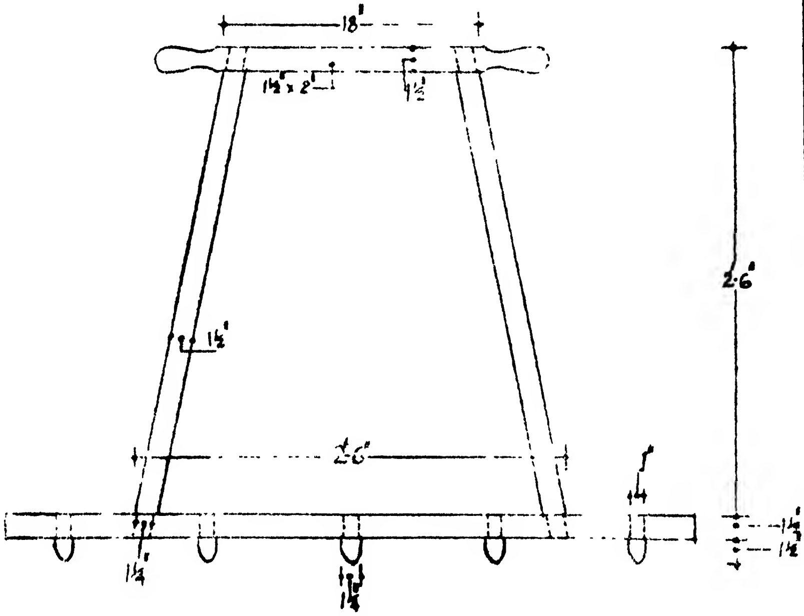
The following particulars show the quantity of mangel seed which will be required per statute acre for 27 and 28 inch drills respectively, and for planting at either 10 inches or 12 inches apart and when either four or five seeds are placed in each "dibble" hole.

Width of Drill	Distance of planting	Quantity of seed required per statute acre	
		Using 4 "seeds"	Using 5 "seeds"
27 inches	10 inches	$4\frac{1}{8}$ lb.	$5\frac{1}{6}$ lb.
27 ,,	12 ,,	$3\frac{1}{2}$,,	$4\frac{3}{8}$,,
28 ,,	10 ,,	4 ,,	$4\frac{4}{5}$,,
28 ,,	12 ,,	$3\frac{1}{3}$,,	$4\frac{1}{6}$,,

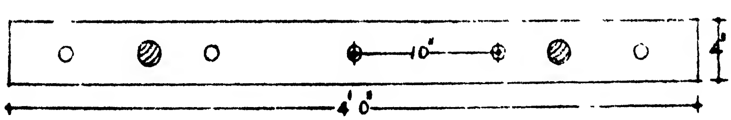
It should be borne in mind that a reasonable crop of mangels can be secured by careful transplanting of seedling plants which have been lifted with a garden trowel or in such other manner as will not injure the delicate rootlets. The method is at least useful for filling "patchy" crops, and will of course, succeed best during moist weather.

ISSUED AS SPECIAL LEAFLET No. 17.
APRIL, 1941.

SEED DIBBLE



ELEVATION



PLAN

SCALE 12 INCHES 0 1 2 3 FEET

FEEDING POTATOES AND OATS TO GROWING CHICKENS

by

E. J. SHEEHY, D.Sc., and E. M. BURKE,

Animal Nutrition Department, University College, Dublin.

The shortage of maize meal, pollard, and bran, foods which, prior to the war, formed the major part of mashes has created a problem for the poultry feeder. Substitutes have to be sought and care must be taken that in making the replacements no essential nutritive ingredient is omitted and that no drastic change in the physical character of the mash is made. Oats we have got in abundance but on account of its comparative bulky and fibrous character, the proportion of it in the mixture must not be excessive. Barley is equal to maize in concentration but unfortunately, it is less plentiful than oats. Potatoes there are, in abundance, but when fed in considerable quantity they make a bulky food for the young chickens. Green material—pasture herbage, cabbage, kale, etc—can, be had in variety and, in addition to the fresh greens, dried grass meal is available in this country from a couple of sources. It appeared desirable in view of the relatively larger quantities of potatoes and oats available to determine the maximum quantities of these foods which may be incorporated in the ration of chickens, and to elaborate a few general principles for the guidance of those who can no longer procure the more familiar pre-war poultry foods.

EXPERIMENT (1).

A hatch of chickens (white wyandottes) was reared for four weeks on a mash made up of :—

bran (wheat)	20	parts
pollard (wheat)	30	,,
maize meal	33	,,
grass meal	5	,,
soya bean meal	12	,,
ground limestone	2	,,
salt	1	,,
cod liver oil	1	,,

It was then divided into 3 groups of 30 chicks each.

Group 1 was allowed to continue on the above mash, fed ad lib and dry throughout the experimental period.

Group 2 was given the same mash ad lib for another week—5th week of life—by the end of which each chicken was consuming about 1½ ounces per day. Thenceforward, the meal was rationed to 1½ ounces per chick per day, fed dry. In addition boiled potatoes were offered ad lib. in a separate trough from the beginning of the 5th week. To begin with, the potatoes were peeled and bruised, but as the chickens became accustomed to them the unpeeled bruised tubers were fed. The potatoes were kept before the birds practically all the time, and in such conditions, it was found that a considerable quantity was consumed.

Group 3 was given the same mash ad lib. for another two weeks—5th and 6th weeks of life—and by the end of the 6th week each chicken was eating about 2½ ounces per day. Thenceforward the meal was rationed to 2½ ounces per chick per day, and in addition boiled potatoes which were fed from the beginning of the 6th week were given ad lib. as in the case of Group 2.

Water was given freely to all groups. In order to ensure that groups 2 and 3 consumed protein and minerals and vitamins A and D, comparable with the consumption of these ingredients by Group 1, the percentage of soya bean meal and of lime, salt and cod liver oil in the meal mixtures fed to groups 2 and 3 was appropriately raised at intervals during the experimental period. This was necessary in view of the limited meal consumption of groups 2 and 3 and in view of the deficiency of the potato in proteins, minerals and vitamins A and D. Actually, at the age of 10 weeks the chickens in group 2 were receiving 1½ ounces of a mixture containing 24 per cent soya bean meal, 4 per cent lime, 2 per cent salt and 2 per cent liver oil ; those in Group 3 were receiving 2½ ounces of a mixture containing 20 per cent soya bean meal, 3 per cent lime, 1½ per cent salt and 2 per cent cod liver oil. The experiment was started in January and because of the thin walled wooden houses in which the birds were accommodated and of the absence of bedding (so as to obviate complications arising from the consumption of the litter) the severe weather affected the weight increments rather adversely. The birds were confined to the house throughout the entire period of the experiment.

The average weight per bird in each group was as follows :—

	Group 1.		Group 2.		Group 3.	
	lb.	ozs.	lb.	ozs.	lb.	ozs.
At 5 weeks of age		9¾		9¾		9¾
At 8 weeks of age	1	3⅛	1	3	1	4½
At 11 weeks of age	1	12¼	1	9⅛	1	14¾

The birds remained in excellent health throughout ; only one chicken was lost from Group 1, and two from each of the others, all the casualties being due

to accidents. The droppings from Group 2 and 3 were very much softer than those from the birds in Group 1, and consequently the floors of the compartments to which groups 2 and 3 were confined were much more difficult to keep dry and clean than that of Group 1.

It will be noted that the birds in Group 2 made less progress than those of group 1, while those in group 3 made greater gains. Observation of the birds confirmed the inference to be drawn from the results namely, that in the rearing of chickens on potatoes ad lib. together with a limited allowance of meals, 1½ ounces of meal per chicken per day is too little while 2½ ounces is ample at any time up to the 12th week of life. The actual consumption of meals by the birds in Group 1, which were allowed free access to the meal trough, was as follows :—

	Ounces per chicken per day.
6th week of life	2
7th week of life ...	2¾
8th week of life	3¼
9th week of life	3½
10th week of life	3¾
11th week of life	4

The consumption of meals and potatoes per chicken per day by Group 3 is given below :—

	Meals.	Potatoes.
6th week of life	2 ozs.	approx. 1 oz.
7th week of life	2½ ozs.	approx. 2 ozs
8th week of life ..	2½ ozs.	approx. 3½ ozs.
9th week of life .	2½ ozs.	approx. 4½ozs.
10th week of life ..	2½ ozs.	approx. 5½ ozs.
11th week of life .	2½ ozs.	approx. 6½ ozs.
12th week of life ...	2½ ozs.	approx. 7½ ozs.

The chickens on a meal allowance restricted to 2½ ounces ate a quantity of potatoes of approximately equivalent food value to that of the meals which, if ad lib. meal feeding obtained, they would otherwise consume. Thus, in the 10th week the comrades of chickens limited to 2½ ounces of meal ate 3¾ ounces of mash ; in lieu of the difference (1¼ ounces meal) the meal restricted birds (group 3) ate 5½ ounces of potatoes. The rate of replacement was 4 of potatoes to 1 of meals. In the 12th week it will be seen that the total consumption of meals and of potatoes in group 3 was in the proportion of 1 to 3—restricted meals and potatoes ad lib.

In this experiment a fourth group, taken from the original hatch was included. With one xception it was treated similar to Group 3. The difference between

groups 3 and 4 was that in the case of the latter the maize meal of the mash was replaced by barley meal and the grass meal replaced by extra bran ; the deficiency in vitamin A (carotene) in Group 4 diet was made up by allowing it fresh green food ad lib. throughout the period of the experiment. Without the green feeding Group 4 would have made very slow progress and many, if not all, of the chicks would have died—ref. grass meal experiment reported in this number—With the green food the chickens in group 4 made equally good progress with those of Group 3.

EXPERIMENT (2).

A second experiment was conducted on a hatch of 112 chickens (white wyandottes) divided into 4 groups after they had been reared for 4 weeks on a mash made up of :—

ground oats	30	parts
pollard (wheat)	28	,,
barley meal	20	,,
maize meal	10	,,
Ext. soya bean meal	12	,,
ground limestone	2	,,
salt	1	,,
cod liver oil	1	,,

Group 1 was fed this mixture throughout the period of the experiment. Group 2, from the fourth week onwards, was put on the following mixture :—

ground oats	50	parts
pollard	28	,,
barley meal	—	
maize meal	10	,,
Ext. soya bean meal	12	,,
ground limestone	2	,,
salt	1	,,
cod liver oil	1	,,

Group 3 was given the same meal mixture as that fed Group 1, but after the 6th week the meals were no longer fed ad lib. ; they were limited to 2½ ounces per chicken per day which was approximately the amount eaten at the end of the 6th week. Boiled potatoes were introduced in the 6th week and were fed ad lib. in a separate trough thenceforward.

Group 4 was treated in the same way as Group 3 except that the meal mixture fed was the same as that given to group 2 i.e., the high proportion of oats.

The birds had abundance of water at all times. As the test progressed the

proportion of soya bean meal, minerals and cod liver oil in the meal mixtures fed to groups 3 and 4 was appropriately increased so as to ensure a consumption of proteins, minerals and vitamins A and D comparable with that of groups 1 and 2, fed meals ad lib.

Weight for age the chicks in group 1 of this experiment were equally good with those of group 1 of experiment (1) that is to say, they made similar weight increments. There was one difference worth noting namely, that in group 1 of this experiment feather picking made its appearance*. Group 2 of this experiment fell behind group 1 in weight increase, but in how far this was due to the extra bulk of the ration (higher proportion of oats) or to the lesser consumption of meals, it is not possible to say. Presumably both factors operated. Groups 3 and 4 made somewhat less but not significantly less gains than groups 1 and 2 respectively, showing that the birds were able, in the case of both diets, to utilise large quantities of potatoes effectively provided the meal allowance was at least 2½ ounces per bird daily.

In this experiment one chicken from Group 1 died of enteritis: three deaths from Group 2 were caused by enteritis; there were no casualties in Group 3. mortality in Group 4 included one caused by enteritis. The increase in the incidence of this disorder as the proportion of ground oats in the mash was raised from 30 to 50 per cent. is worth noting. The oats was ground only to a medium fine grist. The decreased incidence of enteritis in the potato fed groups would suggest that the large bulk of potatoes protected the intestine from any possible effect of irritation which may be caused by unground particles of oat husk. These observations on the occurrence of enteritis support impressions gained from previous experience.

DISCUSSION.

Neither oats nor potatoes contain any vitamin A (carotene) a food factor which is present in yellow maize and which is essential in considerable quantity for growth and health in chickens. In the absence of yellow maize it is necessary to provide carotene from some other source of which, with supplies of cod liver oil short, green feeding is the only one freely available in present circumstances. Abundance of fresh green food or 5 to 10 per cent. of grass meal (of good green quality) supplies adequate carotene.

A convenient method of feeding potatoes to chickens is to place them in a separate trough and allow the birds access to them at all times. In order to insure the maximum consumption of potatoes it is advisable to limit the meal allowance. With potatoes ad lib. sufficient meal is provided at any stage of growth by 2½ ounces per chicken per day, but, of course, birds less than 5 weeks of age will not consume this quantity of meals. When potatoes are fed mixed

---

* Note a similar result from groups fed a high proportion of oats reported in Department's Journal, Vol. XXXVII., No. 1.

with meal the maximum proportions of potatoes for good results are as follows :—

At age of 7 weeks—1 part by weight of potatoes to 1 part by weight of meals.						
At age of 10 weeks—2	,,	,,	,,	,,	,,	
At age of 12 weeks—3	,,	,,	,,	,,	,,	

A meal mixture one-third of which consists of oats is equally good with a similar mixture containing one-third its weight of wheaten bran. Where necessary up to 50 per cent of a chicken meal mixture may consist of oats. An admixture of boiled potatoes with a meal mixture containing oats improves it from the point of view of the health and vigour of the chicken. Oats for chicken feeding should be ground fine more especially when the proportion of oats in the meal mixture is high. It would appear that the needle points of partially ground oat hulls cause injury to the intestine and thus give rise to enteritis.

Both barley and wheat (the available small grain) are suitable for incorporation into a chicken mash in quantity up to any desired proportion, provided, of course, the necessary minerals, proteins and vitamins are fed.

In the presence of direct sunlight and with a sufficient supply of green food the supplementary vitamins are assured.

Separated milk supplies all the proteins and minerals necessary. In its absence minerals and vitamins are provided by 8 per cent of fish or meat meal, but the giving, in addition, of common salt to the extent of one half to one per cent of the ration is of utility. When extracted soya bean meal or ordinary bean meal or dried yeast or any other high protein food is used instead of separated milk for the purpose of supplying the proteins it is necessary to add salt at the rate of 1 per cent and ground limestone or hydrated lime or other lime grit at the rate of 2 per cent to supply sufficient minerals.

Due to the curtailment in the supplies of wheaten pollard and bran, chicken mashes must in many instances be made up in the absence of these foods in which case the utilisation of potatoes, oats and barley to the maximum extent will be necessary.

(Received for publication on 31st July, 1941).

FREEZING INJURY TO POTATO TUBERS

BY

ROBERT McKAY, D.Sc. and PHYLLIS CLINCH, M.Sc., Ph.D.

Department of Plant Pathology, University College, Dublin.

The last three winters have been unusually severe for this country and cold spells in the December—January periods resulted in considerable injury to potato tubers both in storage and in transit. At Glasnevin, potatoes for experimental purposes have been stored continuously in the same house since 1921, but freezing injury was never observed until the years 1938—41. As practically all the potatoes in the store are used for seed in various experiments, observations have been made both on the types of injury shown by the tubers and their subsequent behaviour when planted. These observations have been supplemented by some laboratory experiments as well as by observations on tubers from various other sources.

The average temperature about which potato tubers are liable to freeze i.e. at which ice formation takes place within the tissues, is 29 degrees F. but tubers may be cooled several degrees below this temperature without freezing; any jarring or movement of such undercooled tubers, however, usually results in the immediate formation of ice crystals ((3) (4) (5)). Wright and Diehl (6) point out that the occurrence of freezing injury in potato tubers exposed to temperatures at, or below, 29 degrees F. depends upon a number of variable factors, e.g. the duration of exposure to low temperatures, the type of container in which the potatoes are held, and the internal temperature of the potatoes previous to their exposure to temperatures below the freezing point. Investigators generally are of opinion that injury to potatoes is not caused by low temperature alone unless actual ice formation has taken place in the tissues.

TYPES OF INJURY FOLLOWING EXPOSURE TO TEMPERATURES BELOW THE FREEZING POINT.

The tubers stored at Glasnevin, on which most of the observations were made, included in each year 5—6 hundred tuber units, representing 34 different varieties. The units were contained in 1 lb. chips and some larger bulks in sprouting boxes. None of the tubers was disturbed until several days after thawing. No records of the temperatures within the actual store house are available but the temperatures out of doors for the months of December and January in the years 1938—1941, during which the freezing injury occurred, are shown in Table I. It will be seen that low temperatures occurred on several consecutive days in each season

The following types of injured tubers have been observed :—

A. Soft Tubers—The tubers are quite soft to the touch and exude liquid when pressed between the thumb and finger ; the eyes are blackened and the lenticels encircled by black areas. On cutting, sap flows freely from the raw surfaces which, after a time, turn pink and finally blackish in colour. Tubers of this type are known as "leakers" and they are completely killed. Partial "leakers" sometimes occur in which the softening is local, or tubers may have a rubber-like texture and only "leak" slightly when cut.

The exuded liquid from soft tubers becomes sticky on evaporation indicating the presence of dissolved sugar. It is, of course, well known that low temperatures incite the transformation of starch into sugar within the cells of potato tubers so that the latter turn sweet.

B. Firm Tubers—A great many damaged tubers fail to show any softening whatever but display the following types of injury :—

(1) Internal Necrosis-This is practically always associated with the vascular tissue (Fig. 1). The injury may be confined to a slight browning of the vascular strands or there may be a thickened band of blackened tissue following the line of the vascular ring, or a thin brown line with blotches of necrotic tissue here and there. In rare cases the necrosis occurs in the tissue immediately underneath the skin of the tuber. It should be pointed out that internal necrosis is not necessarily a sign of freezing injury as it is also a symptom of certain virus diseases such as primary leaf roll as well as of some fungus diseases e.g. Verticillium (1).

(2) " Mealiness "—Part of the flesh of practically every firm, injured tuber displays a "mealy" texture and in such areas the cells are dead. Most frequently the "mealiness" is in the region of the vascular ring and in the tissue enclosed by the latter. Sometimes, however, it is confined to the area under the skin or it may be localized in any part of the tuber, very often in the heel end. Cavities usually occur in the "mealy" areas due to the collapse and drying out of groups of cells. The "mealy" condition is not always accompanied by internal necrosis but the affected tissue is usually darker in colour than the normal flesh.

(3) Killing of " Eyes "—All buds may be killed (Fig. 2) but frequently only those at the rose end are destroyed, probably because they are better developed at the critical period. Killing of the eyes is usually, but not always, accompanied by some visible internal injury ; on the other hand, many buds may be viable on tubers displaying internal necrosis and " mealiness."

Killing of eyes may of course be due to other causes besides freezing, e.g. bad attacks of skin spot, ordinary scab, and Fusarium.

(4) Surface Depressions—A common feature of tubers which have been exposed to low temperatures is the presence on them of sunken areas usually about ½ inch in diameter (Fig. 3). This appears to be a localized freezing effect. The cells are killed, moisture is lost and there remains a dry mass of starch grains and cell debris occupying a smaller volume than that of the original cells so that

TABLE I.

Temperatures at and below freezing point during December and January. 1938—1941. (Registered in open at Glasnevin).

Date	December 1938 Degrees Fahrenheit	January 1939 Degrees Fahrenheit	December 1939 Degrees Fahrenheit	January 1940 Degrees Fahrenheit	December 1940 Degrees Fahrenheit	January 1941 Degrees Fahrenheit
1	—	—	—	27	—	29
2	31	29	—	25	—	27
3	31	25	—	23	—	26
4	27	31	—	—	—	25
5	—	21	—	—	—	12
6	—	21	29	—	—	12
7	—	—	26	—	32	31
8	—	—	—	30	32	31
9	24	—	—	31	—	—
10	29	21	—	28	—	26
11	—	24	—	24	—	—
12	—	24	.	18	30	32
13	—	25	31	20	—	29
14	—	21	—	18	—	30
15	—	—	—	18	—	24
16	—	—	—	27	—	14
17	25	—	—	11	27	22
18	28	—	—	11	—	25
19	29	32	32	16	29	—
20	25	32	28	17	29	31
21	26	—	29	13	—	—
22	17	26	26	19	—	32
23	14	—	30	21	—	25
24	20	24	29	—	—	29
25	28	22	26	—	—	—
26	32	27	—	—	29	—
27	—	32	28	—	28	—
28	32	31	29	—	25	—
29	—	28	26	—	—	—
30	32	—	28	32	—	—
31	28	27	27	32	-	—

the skin sinks in. Dry Rot (*Fusarium caeruleum*) frequently develops in these areas.

It has been observed that somewhat similar depressions may be caused by the attacks of certain mildly parasitic fungi, but in such cases the fungus mycelium can be detected by microscopic examination.

LABORATORY EXPERIMENTS

The scope of these was limited by the fact that they were carried out in an ordinary household refrigerator, the freezing chamber of which could only accommodate 12 tubers at a time. The temperature in the freezing chamber was 17 degrees F. and that in the main body of the refrigerator was 28 — 30 degrees F. Uniform tubers of 3 varieties (Kerr's Pink, Up-to-Date and Early Rose) were used, all of which had previously been stored in an outhouse. The tubers, contained in open wooden boxes, were submitted to the temperatures mentioned for varying periods of time and at the end of each period the temperature was allowed to rise **without disturbing the tubers** which were not returned to the store house for 24 hours.

The information derived from these tests may be summarised as follows :—

(1) All three varieties reacted similarly, but there was a striking difference in the resistance of individual tubers to low temperatures. Certain tubers were unaffected by considerable under-cooling.

(2) Of tubers exposed to 17 degrees F. for 18 hours, the majority were complete "leakers" and the remainder were uninjured.

(3) Of tubers exposed to 17 degrees F. for 4 hours and 6 hours, the majority showed the dry type of injury i.e. internal necrosis and "mealiness" and more or less killing of eyes. A small number were rubbery and "leaked" slightly and a few were unaffected.

(4) Tubers exposed to 17 degrees F. for 2 hours were uninjured.

(5) Tubers exposed to 28—30 degrees F. for (a) 18 hours and (b) 72 hours were uninjured.

(6) Tubers with tough skins and short leafy sprouts, treated on 1st April were more resistent than those of the same batch examined four months previously. However, 18 hours at 17 degrees F. resulted in a number of "leakers" on each of which the sprouts were killed. The remaining tubers were unaffected.

In addition to the refrigerator experiments, 36 tubers were placed in a sack on the concrete floor of a cold glasshouse during the spell of severe frosty weather in January 1940 and were left undisturbed for a period of nine days. A thaw set in on the 8th day, but previous to this the minimum night temperatures in the glasshouse varied from 20 degrees to 23 degrees F. reaching 28 degrees F. on one night only. On examination of the tubers it was found that 7 "leakers" occurred in the upper, exposed portion of the sack, 11 tubers showed no visible injury and

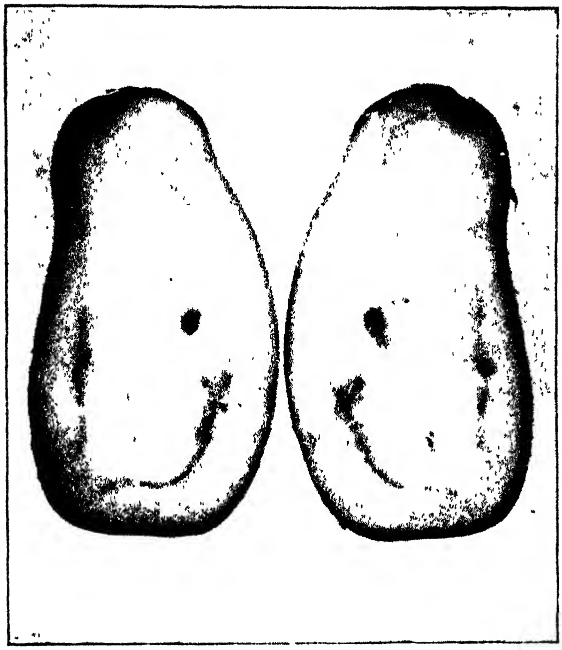


Fig. 1.- Tuber showing internal necrosis of medium severity due to freezing injury.

Fig. 2.—Tuber (var. Majestic) showing killing of eyes due to freezing injury. Note firmness of tuber which was photographed after 12 months' storage. (*Photographs by G. H. McLean*).

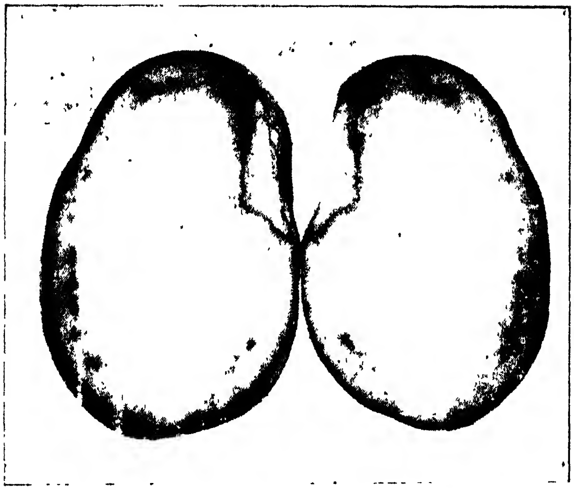


Fig. 3.—Tuber showing sunken depression and slight necrosis of vascular tissue due to freezing injury.

Fig. 4.—Premature tuber formation following planting of potato subjected to freezing (var. Dunbar Standard).
—(*Photographs by G. H. McLean*)

Fig. 5.—Spindling sprouts on tuber injured by freezing. (*Photograph by G. H. McLean*).

the remaining 18 displayed varying degrees of internal necrosis and bud injury. The experiments confirm Wright's and Diehl's (6) view that "leakers" represent the extreme form of injury and also that temperatures around the freezing point do not necessarily cause injury in undisturbed tubers even after 72 hours. Soft tubers are, of course, produced at temperatures above 17 degrees F. Wright and Diehl obtained 15 per cent. "leakers" in Triumph and Irish Cobbler potatoes after 48 hours but not after 32 hours' exposure to 27 degrees F. In a second experiment, softening occurred after 32 hours but not after 24 hours' exposure at 27 degrees F., while at 22 degrees F. 60—70 per cent "leakers" occurred after 21 hours. Obviously the lower the temperature, the shorter is the time required for the production of "leakers."

INDIVIDUAL VARIATION IN RESISTANCE TO LOW TEMPERATURES

This was the most striking feature in all cases examined by the writers and has also been the subject of comment by other investigators. In the store house at Glasnevin, following the cold spells of 1938-41, practically every one of the five to six hundred tuber units showed some injury. With few exceptions, however, each unit contained a certain number of sound tubers, the remainder showing various types of injury. Frequently, all types occurred in the same chip. This variation was also evident in the laboratory experiments, the extreme case being that of tubers submitted to 17 degrees F. for 18 hours in which two out of 12 tubers were uninjured, the remainder being "leakers." The variety of tubers present in the store house rendered possible the conclusion that the injury produced cannot be specifically related to any particular condition of the tubers for all types suffered, from those which were smooth and firm and completely dormant to those which had large sprouts and rough shrivelled skins. All sizes too, were damaged. Speaking generally, however, it can be said that large, turgid tubers appeared to suffer most. It is not possible, either, to discriminate between the powers of resistance of different varieties, but Up-to-Date, Arran Crest, Epicure, Champion, Arran Banner and Arran Cairn were amongst the most susceptible. Wright and Diehl (6) found some difference in the resistance of three American varieties of potato.

SUBSEQUENT BEHAVIOUR OF TUBERS SUBJECTED TO TEMPERATURES BELOW THE FREEZING POINT.

This is naturally a most important aspect in the case of potatoes destined for seed and one to which special attention has been given. The observations made at Glasnevin may be summarised as follows:—

(1) "Leakers" furnish a rich medium for organisms of all kinds and soon decay.

(2) Tubers, although perfectly firm, may fail to sprout at all, due to the eyes being dead. Such tubers are still firm after 12 months storage (Fig. 2).

(3) Injured eyes on firm tubers may produce very weak, spindling sprouts from subsidiary buds which, if conditions are at all adverse, fail to survive and at best produce very weak shoots after considerable delay (Fig. 5).

(4) Uninjured eyes on tubers which show internal necrosis or "mealiness" sprout normally if somewhat slowly ; they may produce normal shoots if growing conditions are so favourable that independent roots are formed rapidly. Under adverse conditions however, they are liable to perish due to the inadequate supply of nourishment from the injured tuber or the early decay of the latter.

In cases where tubers were already strongly sprouted at the time of exposure, premature tuber formation without production of aerial parts took place under dry soil conditions *(Fig. 4).

Tubers which have been super-cooled but which fail to display internal or external injury produce normal plants.

Apart from these direct effects, losses may occur in bulk lots of frozen potatoes as shown by the following observation. Forty tubers each of Kerr's Pinks and Up-to-Date were submitted to this laboratory by Mr. J. J. Major of the Department of Agriculture on 23rd January, 1939. These tubers were part of a consignment which had been frozen in transit to Liverpool and they were taken from sacks containing 50—80 per cent "leakers." The tubers submitted were apparently sound but many were covered by the syrupy exudation from soft tubers. They were placed in clean sprouting boxes in a cool room where they remained for two months. At the end of this period about 30 per cent of the tubers of both varieties were affected with Dry Rot due to ***Fusarium caeruleum*** while control tubers of the same varieties stored in the same room developed only 1 per cent Dry Rot. ' It is concluded that the exudation from soft tubers, although probably not directly toxic to sound tubers with which it may come in contact, is harmful in so far as it furnishes a rich medium for the growth of parasitic fungi thereon.

DISCUSSION.

It is clear from what has been said that the prejudice which exists amongst merchants against accepting cargoes which have been frozen in transit is well founded. However carefully re-handled, it would be impossible to exclude all types of injured tubers without cutting every individual tuber. Such consignments should not be used for seed purposes unless absolutely necessary. Wright et al (7) estimated the yields from three varieties of potato which had been subjected to freezing temperatures and from which all soft and wet specimens had subsequently been removed. They found a reduction in yield as compared with that of untreated lots of from 27.07 to 95.37 bushels per acre according to variety. If it is suspected that freezing has occurred and that soft tubers

* The phenomenon of premature tuber formation has been known for over 100 years (2). It may be due to several other causes besides freezing injury, including (i) repeated removal of sprouts from early varieties like Duke of York ; (ii) secondary leaf-roll.

have been removed, sample tubers should be cut across at the heel end when the appearance of "mealiness" and necrosis will confirm the suspicion.

Although much injury to stored potatoes resulted from the cold spells of the last three winters it must be admitted that such periods of prolonged low temperatures are abnormal in this country. Nevertheless, they are liable to occur again but if proper precautions are taken no loss need be incurred. Pitted potatoes can be adequately protected by increasing the depth of covering soil and by lining the latter with straw, if procurable ; in the case of potatoes stored in sheds, a lamp should be available for keeping up the temperature to 30 degrees F. during spells of extremely cold weather.

If prolonged low temperatures have been experienced during the winter subsequent "misses" in the potato field may be avoided by sprouting the tubers before planting and using only those which sprout normally. This procedure, indeed, has been consistently recommended by the Department of Agriculture, but is particularly desirable after a severe winter, when freezing injury may have occurred.

REFERENCES.

1. Folsom, D., Libby, W. C., Simpson, G.W. and Wyman, O. L.—University of Maine Extension Bul. No. 246, 1938.
2. Lemon, C.—Journ. Roy. Agric. Soc. of England. 4 : 431-35, 1843.
3. Müller—Thurgau, H.—Landw. Jahrb. 9 : 133-189, 1880.
4. ——————————*Ibid.* 11 : 751-828, 1882.
5. ——————————*Ibid.* 15 : 453-610, 1886.
6. Wright, R. C. and Diehl, H.—U.S. Dept. Agr. Tech. Bul No. 27, 1927.
7. Wright, R. C. Peacock, W. M. and Lombard, P. M.—U.S. Dept. Agr. Tech. Bul. No. 119, 1929.

(Received for publication on 26th July, 1941).

LAYING FOWL AND GROWING CHICKENS REQUIRE VITAMIN A

by

B. J. SENIOR, M.Sc., and E. J. SHEEHY, D.Sc., F.R.C.Sc.I.

Animal Nutrition Department, University College, Dublin.

It is well known that fowl in common with other farm animals require supplies of Vitamin A to enable them to maintain health and to achieve a satisfactory rate of growth and egg production. In the past, the need for directing particular attention to this constituent of the fowl's ration has not often arisen, because it has been supplied in abundance by ingredients incorporated in the ration primarily for other reasons. Thus, cod liver oil, commonly used as a source of vitamin D, is also a potent source of vitamin A. Yellow maize containing a carotenoid pigment from which the fowl elaborates vitamin A was usually included to the extent of about 30 per cent. in poultry mashes; furthermore, kibbled maize or cracked corn often formed portion of the grain supplement of laying fowl. Where in addition to these sources of Vitamin A, poultry were on free range or had otherwise access to a plentiful supply of green material, which is very rich in carotene, a deficiency of this vitamin was not likely to occur. In view therefore of the disappearance of maize from the market and the severe curtailment of supplies of cod liver oil, there is a grave danger that the need for supplying vitamin A may be overlooked. Consequently it was considered advisable to plan some feeding trials which would demonstrate how easily a condition of vitamin A deficiency may be brought about, and which would draw attention to the ill effects of such deficiency in the case of the laying hen and growing chicken. As grass meal is now made in this country and will doubtless be widely used during the coming winter as a source of vitamin A it was arranged to include it in some of the rations at different levels with a view to getting some information as to the minimum amounts necessary for that purpose.

The amount of green material required will of course depend on the carotene content. Thus, American work (1, 2,) has shown that alfalfa when used as a source of vitamin A should form from 1 per cent to over 10 per cent of the fowls ration depending on its carotene content. The variation in the analysis of grass meal as made from our mixed pasture grass is not so marked as that of American alfalfa meal appears to be. In any case if the percentage of grass meal of a certain carotene content which must be incorporated in a mixture be determined, allowance can always be made for samples of similar origin with a slightly different analysis. In the trials on laying hens reported herein, two levels of grass meal were chosen, namely 10 per cent and 20 per cent of the meal mixture fed, and in the case of growing chickens levels of 5 per cent and 10 per cent were tested.

EXPERIMENTAL.

LAYING PULLETS.

White Wyandotte pullets about 8½ months old were selected from a large flock in November 1940. The pullets had been reared on grass runs, and from the age of a few weeks their meal ration had contained 30 per cent of yellow maize. Only those birds which had been laying for at least a month were chosen for the experiment. As far as could be judged they were all in perfect health. During the six months of experimental feeding the birds were confined in large houses to which direct sunlight had access. They were divided so that each house had approximately the same number of birds per square yard of floor space.

The grass meal contained an average of 30 mgrm carotene per 100g of dry matter, and 13 per cent of crude protein. The carotene was determined by the method of Ferguson & Bishop (3). The grass meal had been stored for a period of 6 months prior to the commencement of the experiment.

Dry mash was given to the limit of appetite. An equal amount of grain was fed in the evening—the mixture being made up of equal parts of barley and cockle wheat. Water and oyster shell were fed ad lib. Wheat or barley straw was used as litter.

The mixtures given to the various groups were as follows :-

	Group I	Group II	Group III	Group IV
Bran	20	20	20	20
Pollard	20	20	20	20
Barley meal	30	30	30	--
Maize meal	---	--	–	30
Grass meal	---	10	20	-
Finely ground oats	20	10	---	20
Meat meal	8	8	8	8
Ground limestone	1	1	1	1
Salt	1	1	1	1

The birds were trap nested and a record kept of the production of each. An examination of the record sheets did not show any difference between the groups with respect to the size of egg. The total number laid by each bird was therefore taken into account for comparative purposes. In calculating the number of hen-days for each group, a bird which died was treated as if she had been removed from the experiment on the day on which she had laid her last egg even though death did not occur until some time later. As most of the deaths were in group I (the control group) and were ascribed to a deficiency of vitamin A, it

is considered that this is fairer than penalising the group with a big number of hens for the number of days during which they were ill prior to death. Unfortunately, in the middle of March, owing to shortage of feeding stuffs all groups had to be culled. The numbers removed from the groups were respectively 5, 4, 4, 4. In calculating the average number of pullets these were treated in the same manner as were deaths. Table 1 gives the relevant data :—

TABLE 1.

	Group I Control	Group II 10% Grass meal	Group III 20% Grass meal	Group IV 30% Maize
No. of birds at commencement of the experiment (11/11/'40).	32	26	22	23
No. of birds at conclusion of the experiment (11/5/'41)	8	19	16	15
Total number of hen-days	4529	4109	3626	3570
Average number of pullets	24.9	22.6	19.9	19.6
Average number of eggs per pullet	62.6	80.7	79.8	86.6

It will be seen that the number of eggs per pullet in group I (getting neither grass meal nor maize) is much lower than in any other group.

Table 2 gives particulars of deaths in the various groups.

TABLE 2.

	Group I Control	Group II 10% Grass meal	Group III 20% Grass meal	Group IV 30% Maize
Total Number of deaths	19	3	2	4
Number ascribed to vitamin A deficiency	16	0	0	0

The 12 deaths amongst the four groups due to causes other than vitamin A deficiency, were brought about by such causes as burst oviduct, peritonitis and accidents. The post mortem reports on the 16 pullets where death has been ascribed to a deficiency of vitamin A included the following causes of death or symptoms of disease :—marked nephritis, gout, enteritis, infectious colds, peritonitis, eye inflammation, diseases of the respiratory tract. During the first three months there was only an occasional death but thereafter they became

increasingly frequent. For many weeks prior to death the birds showed a listless appearance not unlike that associated with coccidiosis. The feathers were ruffled and inclined to stand out from the head. Some birds were inclined to stagger occasionally. All of them developed a peculiar staring appearance in the eye, and in most cases there was inflammation and lesions around the eye prior to death. The pathological conditions reported are comparable with those usually associated with vitamin A shortage.

The livers of birds which died were assayed for vitamin A ; also at the conclusion of the experiment a number of healthy birds from all groups were killed for this purpose. The method of Davies (4) was used for the extraction of the livers. An examination of the livers of pullets which had been on a common ration for 6 months showed great variation in the reserves of vitamin stored. No attempt therefore was made in this experiment to correlate the amount of vitamin found in the livers with the amount of carotene fed. Sufficient evidence for the purposes of this experiment was obtained by simply determining whether or not vitamin A was present in the livers. In no case was any trace of the vitamin found in the livers of birds which died in group I. On the other hand all livers from groups II, III & IV contained considerable amounts.

At regular intervals a number of eggs from each group were taken and the colour of the yolks compared. At the beginning there was approximately the same amount of pigment in the eggs from all groups. One month after the commencement of the experiment the colour of the yolks of group 1 eggs was definitely lighter than that of eggs from any of the other groups and by the end of two months the eggs from group I no longer showed any yellow or orange colour. It is interesting to note that at this stage the pullets had not yet shown any gross symptoms of ill-health, so that the disappearance of colour from the egg-yolk in such cases might be taken as a warning of an approaching condition of vitamin A deficiency. The yolk colour did not fade in any of the other 3 groups at any stage of the experiment. In fact as the experiment progressed, the colour deepened slightly in group 3 (20 per cent. grass meal).

DISCUSSION (LAYING PULLETS).

The results emphasise the possibility of the occurrence of Vitamin A deficiency in the feeding of laying fowl kept intensively. The pullets in this experiment having been reared on grass runs and having had 30 per cent of yellow maize in their ration since the age of a few weeks, entered on their period of winter laying with a good reserve of vitamin A. Within a few months signs of deficiency were in evidence. The colour disappeared from the egg yolks, egg production declined, ill-health developed, and within six months just half of the number in the vitamin deprived group had died. The post-mortem examination of the carcases, together with the complete absence of vitamin A in the livers of birds from group I compared with the normal health and production in the other three groups leaves no doubt as to the cause of death. It would appear that

10 per cent. of grass meal (containing 30 mgrm. carotene per 100 g) provides an ample supply of vitamin A for the requirements of laying pullets during the winter months at least in those cases where the pullets have had a good supply of carotene during the rearing period. The deeper colour of the egg yolk in group 3 (20 per cent grass meal) would suggest that the fowl metabolised and stored a greater quantity of carotenoid pigments in this group, but there is no suggestion that it was necessary for health or for egg production.

Cod liver oil, which is a potent source of vitamin A as well as of vitamin D, gives complete protection to laying fowl from the diseased conditions associated with a deficiency of vitamin A and is effective in preventing the decline in egg yield, but it does not impart pigment to the egg yolk. Fresh green food such as pasture herbage, cabbage, lettuce, kale, possesses all the virtues of dried grass meal; indeed it is as good not alone as a source of vitamin A but also as a source of minerals and proteins, and its physical effect on the food tube of the bird is far more favourable than that of the dried grass meal. The chief lesson to be learned from the work reported is that in the absence of maize and cod liver oil the inclusion of fresh green food or dried grass in the diet of laying fowl is essential because no other items of poultry rations contain any appreciable quantity of vitamin A.

EXPERIMENTAL.

GROWING CHICKENS (a).

Week old chickens were divided into 4 groups of 35 each in September 1940, and were confined to houses fitted with a slatted platform raised about a foot from the floor. The windows were removable so that direct sunshine entered the houses. The following food mixtures were provided:—

	Group I	Group II	Group III	Group IV
Bran	15	15	15	15
Pollard	35	35	35	35
Maize Meal	—	—	30	30
Barley Meal	30	30	—	—
Oats	10	—	10	—
Meat Meal	8	8	8	8
Ground limestone	1	1	1	1
Salt	1	1	1	1
Grass Meal	—	10	—	10

It will be seen that the rations were divided so that the energy content of all four groups was approximately the same. The ration of Group I was deficient

in vitamin A. In group II vitamin A was supplied from the grass meal, and in group III from the maize meal. Group IV supplied it from both sources.

As was to be expected group I very soon showed evidence of the shortage of vitamin A. They made very slow progress compared with the other three groups and at the end of 4 weeks 11 chicks had died. The rate of mortality increased and 9 weeks after the commencement of the experiment none survived in group I. In 26 cases death was ascribed to conditions brought about by a deficiency of vitamin A. In all but 3 of these cases no trace of vitamin A was found in the liver. On the other hand, when the livers of birds from the other three groups which had died during the experiment (7 in all) were examined, there was vitamin A in all of them. The experiment was concluded when the birds reached the age of 12 weeks. Four of the most backward birds from groups II, III and IV were then killed and their livers assayed for vitamin A. In all cases considerable quantities were found to be present.

There was no appreciable difference in rate of growth or food consumption between groups II, III, IV. Apparently, either 10 per cent of grass meal or 30 per cent maize provides sufficient vitamin A for the requirements of growing chicks.

GROWING CHICKENS (b).

Week-old White Wyandotte chicks were divided into three groups of 25 each in February 1941 and fed the following mixtures :—

	Group I	Group II	Group III
Bran	23	18	28
Pollard	30	30	30
Barley meal	27	27	27
Soya bean meal	12	12	12
Grass meal	5	10	—
Ground limestone	2	2	2
Salt	1	1	1
Cod liver oil	—	—	1

The chickens were confined to houses with wire floors raised off the ground. Direct light freely entered the interiors. It was not considered necessary to include as a control a group deprived of all vitamin A as the previous experiment had shown that the birds in such a group would survive only a short time. Group III was however included to serve as a comparison. It will be seen that as far as is known, the ration provided to group III was complete in every respect, so that the chickens in that group should be representative of birds growing at an optimum rate.

All three groups made good progress, feathered well and showed no signs of ill-health. The weekly increase in weight was similar in all groups, as was also the food consumption. The livers of birds which died during the experiment (8 in all) were assayed for vitamin A and in all cases definite amounts were present. At the conclusion of the experiment at 14 weeks of age 6 representative birds were taken from each group and their livers examined. Considerable amounts of vitamin A were found in all cases. The livers from group II (getting 10 per cent of grass meal) showed an increased reserve over those from either group I (5 per cent grass meal) or group III (1 per cent. C.L.O.). This does not mean that the current requirements of the birds were not met in the latter two groups as it is known that animals can metabolise carotene and store it as vitamin A in their livers to a very great extent, when it is fed in excess of normal requirements.

The results of this test show that 5 per cent of the grass meal used provided sufficient vitamin A for the needs of the growing chicken. The grass meal fed in chicken feeding experiments (a) and (b) was from the same sample as that used in the laying pullet experiment.

DISCUSSION (GROWING CHICKENS).

In the absence of a potent source of vitamin A a chicken mash, no matter how varied, is incapable of supporting life for any protracted period. Dried grass meal has proved effective in supplying the full vitamin A needs of the chicken, and 5 per cent of the sample of grass meal used, incorporated into a meal mixture, provided an adequate supply. As the carotene content is known to decrease with storage, it would be a safe precaution to include grass meal in excess of 5 per cent, unless the potency of the sample is assured. It may be fed up to the extent of 10 per cent without causing any injury. Cod liver oil is, of course, a good source of vitamin A for chickens, but the curtailment of supplies as well as the absence of maize from the list of available foods renders it necessary for rearers to provide sufficient green feeding, either fresh or dried, to supply the high requirements of chickens in respect of vitamin A. As already mentioned fresh green food is superior to the dried grass meal not alone in vitamin A content but in other respects also.

SUMMARY.

Experiments have been conducted to show that in the absence of maize meal and cod liver oil, particular attention must be directed to the vitamin A requirements of laying fowl and of growing chickens. The lowest levels of grass meal (containing 30 m.grm. carotene per 100 grams dry matter) fed were 10 per cent to laying pullets and 5 per cent to growing chickens. In both cases these amounts proved adequate to enable the birds to elaborate sufficient vitamin A for their needs.

ACKNOWLEDGMENTS.

We are indebted to Professor Kearney in whose laboratory at the Veterinary College the post-mortem examinations were made, and to Miss E. M. Burke who supervised the feeding trials and collected the data.

REFERENCES.

1. Bearse & Miller, Poultry Sci. 1937, 16, 34.
2. Williams, Lampman & Bolin, Poultry Sci. 1939, 18, 268.
3. Ferguson & Bishop, Analyst 1936, 61, 515.
4. Davies, Biochem. Jr. 27 1770.

(Received for publication on 31st July, 1941).

PIG FEEDING EXPERIMENTS AT THE DEPARTMENT'S FARMS.

Experiments designed to determine the effect of restricted rationing at different stages in the feeding period on the quality of bacon were conducted at the Department's farms during 1939. In a preliminary trial the effect of reducing the ration towards the end of the fattening period was investigated.

A group of 26 pigs, about 12 weeks old, was selected and fed in the manner usually practised at the farms until they had reached the stage when they might have been expected with normal feeding to reach bacon weights at the end of a further period of about four weeks.

Particulars of the pigs during the preliminary period are given in Table I.

TABLE I.

No. of Pigs	Average Weight at beginning	Average Weight at end	Average live weight increase	No. of days fed	Average daily live weight increase	Average consumption of food per head	Average consumption of food per lb. live wt. increase
	c. q. lb.	c. q. lb.	c. q. lb.		lb.	c. q. lb.	lb.
26	0 2 20	1 1 5	0 2 13	49	1.41	2 1 22	3.97

At the end of the preliminary period the pigs were divided into two equal groups, similar as regards age, sex, and weight, and fed until they reached bacon weights. Group I was fed to full appetite while Group II was restricted to four fifth of the quantity of food given to Group I. Otherwise the groups were treated exactly alike. There was no change in the quality of food throughout the trial.

The general health and progress of the pigs was on the whole satisfactory, although a few animals in the restricted group suffered a set-back for a few days after the ration was curtailed.

Particulars of the progress of the groups to the end of the fattening period are given in Table II.

TABLE II.

Group	Average Weight at beginning of final feeding period	Average Weight at end of final feeding period	Average live weight increase	Average duration of trial	Average daily live weight increase	Food consumed per lb. live weight increase	Average dead weight	Average dead weight as a percentage of live weight
·	c. q. lb.	c. q. lb.	c. q. lb.	days	lb.	lb.	c. q. lb.	%
Control	1 1 4	1 3 17	0 2 13	35	1.97	3.94	1 1 17	74
Restricted	1 1 5	1 3 10	0 2 5	39	1.56	4.09	1 1 23	79

Particulars of factory classification and Grading are given in Table III.

TABLE III.

Group	No. in Group	CLASS				No. of carcases in each grade		
		I	II	III	Not classified	A	B	C
Control	13	8	2	2	1	1	7	4
Restricted	13	12	—	1	—	6	6	1

Particulars of the amounts of food consumed and prices realised for each group together with the average prices realised per head are set out in Table IV.

TABLE IV.

Group	Total food consumed			Price realised			Average price per head		
	c.	q.	lb.	£	s.	d.	£	s.	d.
Control .	31	2	4	62	12	9	4	16	4
Restricted . ..	28	3	19	66	6	6	5	2	0

While the bacon produced from both groups was on the whole satisfactory, that from the restricted group was considered to be of superior quality. Although definite conclusions cannot be drawn as a result of one experiment of this nature an examination of the Tables above indicates that restricted rationing during the final stages of fattening appears to be a somewhat more economical method of bacon production than feeding to full appetite during the entire fattening period.

In order to obtain more definite information regarding the effects of restricted rationing on the economy of bacon production a further series of trials was conducted at the Department's Farms. In this series the effects of restricting the amount of food at different stages in the fattening period were compared.

Seventy-two pigs about 12 weeks old were selected and divided into four uniform groups, similar as regards age, sex, weight, etc., and fed until they reached bacon weights. It was estimated that the experimental period would extend over about four months, and accordingly, the fattening period was divided into two periods of approximately two months each. The meal mixture fed to all four groups during the trial was composed of:—

60 parts by weight of maize meal mixture.
55 ,, ,, pollard
5 ,, ,, bran

The meal ration fed to each group was regulated on the lines set out in Table V.

TABLE V.

No. of Group	First Period	Second Period
I	Meal ration fed to appetite for two months.	Meal ration fed to appetite for remainder of fattening period.
II	Half the quantity of meal ration fed to Group I for two months.	Meal ration fed to appetite for remainder of fattening period.
III	One-quarter the quantity of meal ration fed to Group I together with some raw potatoes or roots and grass making in all about half the quantity of food given to Group I for two months.	Meal ration fed to appetite for remainder of fattening period.
IV	Meal ration fed to appetite for two months.	Two-thirds the quantity of meal ration fed to Group I for remainder of fattening period.

Separated milk at the rate of 4 pints per pig daily was fed to each group throughout the experiment.

Groups I, II, and IV were kept indoors throughout the whole experimental period while Group III had free access to a paddock during the first period of two months.

The general health and progress of the pigs in Groups I and IV were satisfactory throughout. While the health of the pigs in Group II was also satisfactory it

was observed that some of them were restless during the first period. There was also a tendency to excessive salivation while some of them were inclined to eat their bedding.

At one centre the pigs in Group III did not consume much of the raw potatoes and remained thin during the First Period. At this centre also one of the pigs in Group III which had not been thriving for some time developed pneumonia and died towards the end of the Second Period. In the circumstances the data relative to Group III from this particular centre were not included in the preparation of the final figures. At the remaining centres the pigs in this Group made satisfactory progress.

Particulars of the progress of the Groups throughout the trial are given in Table VI.

TABLE VI.

No. of Group.	No. of Pigs in Group.	Average Weight at begining of Trial			Average Weight at end of trial.			Average live weight increase.			Average duration of trial.	Average daily live weight increase.	Food consumed per lb. live weight increase.	Average dead weight.			Average dead weight as a percentage of live weight.
		c.	q.	lb.	c.	q.	lb.	c.	q.	lb.	days	lb.	lb.	c.	q.	lb.	%
I	18	0	2	8	1	3	19	1	1	11	94	1.61	3.97	1	1	19	74
II	18	0	2	7	1	3	17	1	1	10	105	1.43	3.62	1	1	20	75
III	12	0	2	7	1	3	7	1	1	0	102	1.37	3.22*	1	1	10	74
IV	18	0	2	7	1	3	12	1	1	5	103	1.41	3.86	1	1	19	76

*Meal equivalent only.

Particulars of factory classification and grading are given in Table VII.

TABLE VII.

Group	No. in Group	Number of Carcases in each Class			Number of Carcases in each grade				Percentage of Carcases in each grade			
		I	II	III	Bonus	A	B	C	Bonus	A	B	C
I	18	16	1	1	—	11	5	2	—	61	28	11
II	17*	15	2	—	2	7	5	3	12	41	29	18
III	12	11	—	1	1	10	1	—	8	83	8	—
IV	18	16	1	1	1	12	4	1	5	67	22	5

* One pig not graded owing to injury.

Particulars of the average amounts of food consumed and prices realised per head for each group are presented in Table VIII.

TABLE VIII.

GROUP	Average quantity of food consumed per pig.			Average price realised per head.		
	c.	q.	lb.	£	s.	d.
I	5	1	11	5	1	2
II	4	3	11*	5	1	5
III	4	0	4	5	0	1
IV	5	0	0	5	2	1

* Meal equivalent only.

The results of these trials show that while the pigs which had their rations restricted required a somewhat longer feeding period to reach bacon weights, they graded better, consumed less meals and on the average realised as high a price per head as the pigs which were fed according to appetite throughout the experimental period.

Although it would be unwise to rely too much on the results from a small number of trials it would appear that an improvement in the quality of the carcase can be obtained by restricting the quantity of food fed to bacon pigs, especially during the latter half of the fattening period, while at the same time economy in the use of meals can be effected—an important consideration in present circumstances.

IRISH CORAL SAND AS A SOURCE OF LIME FOR LAYING HENS

by

J. BROPHY, B.Agr.Sc., and E. J. SHEEHY, D.Sc., F.R.C.Sc.I.

Animal Nutrition Department, University College, Dublin.

An experiment has been conducted for the purpose of ascertaining whether a coral sand found off the south west coast of this country is suitable as a source of lime for laying hens. As a basis of comparison oyster shell, which is a popular component of poultry diet was used: opportunity was taken to determine at the same time the comparable utility of lime-mortar for the purpose. Two types of coral sand, one a slatey-grey and the other a brownish sample both supplied through the Department of Agriculture, were used ;the oyster shell was the ground material ordinarily used by poultry keepers ; and the lime mortar was prepared by mixing slaked quicklime with sand and leaving the mixture exposed to the air for some time.

The efficacy of any material used for the purpose of supplying lime would depend on (1) the content of calcium and its availability (2) palatability (3) the absence of any substance or property which would be injurious to the health of the birds or which would adversely affect production. Accordingly, an analysis was made, and the materials to be compared were fed for a prolonged period to groups of fowl the production and health of which were observed.

Seven pens, each comprising fifteen hens and a cock were used for the experiment which began on the 15th November 1940 and continued for 18 weeks. The birds had access to grass runs throughout except for about ten days when snow covered the ground. Prior to the experiment all groups got oyster shell as their lime supplement and during the experiment all groups were treated alike except for the type of " grit " supplied. The "grit" i.e. oyster shell, coral sand and lime-mortar, was allowed ad lib and the consumption recorded weekly. One feed of oat grain was given each day and a meal mixture, fed dry, was supplied ad lib, as was water, and the average quantity of each consumed per week determined.

The following meal mixture was used :—

Pollard	1 cwt.
Bran	1 cwt.
Maize Meal	1 cwt.
Grass Meal	30 lb.

Extracted Soya Bean Meal	20 lb.
Meat meal	20 lb.
Salt	3½ lb.

The birds were weighed at the beginning and at the termination of the experiment.

The analysis of the lime supplements used was as follows :—

	Calcium	Chlorine
	%	%
Grey Coral Sand	30	negligible
Brown „	32.8	negligible
Oyster Shell	39.7	—
Lime Mortar	35	—

The consumption of grain and of meal which was approximately the same in all groups (pens) averaged 2.85 and 2.26 ounces respectively per bird per day and that of water averaged over a quarter of a pint per bird per day throughout the period.

RESULTS.

Table I gives the relevant data with regard to consumption of "grit," egg production and weight of birds.

TABLE I.

GROUP	Type of "Grit" or Lime Supplement	Grit Consumed per bird per day (oz)	Calcium consumed per bird per day in Water & Food (other than grit) (oz)	Calcium consumed per bird per day in form of "Grit" (oz)	Total Egg Production over period of Experiment (number)	Initial Average Weight of Hens (oz)	Final Average Weight of Hens (oz)
1.	Grey coral sand	0.15	.018	.04	468	77.8	86.1
2.	do.	0.30	.018	.09	500	76.1	77.5
3.	Oyster shell	0.20	.018	.08	661	82.9	82.2
4.	do.	0.16	.018	.06	578	84.3	[illegible]
5.	Brown coral	0.26	.018	.09	283	76.0	93.0
6.	do.	0.31	.018	.10	613	76.3	86.1
7.	Lime Mortar	0.07	.018	.03	486	83.3	81.0

With the exception of Group 5 the egg production, considering the time of the year and the fact that second season birds were used was reasonably good in all pens. No appreciable difference in production is indicated and because of the small numbers of birds, statistical analysis of the figures would not be justified. An explanation of the comparatively low egg production from Group 5 is forth coming from the fact that the birds in this pen, being third season, were in poor lay at the commencement of the experiment and only came into good production towards the end of the experimental period. The birds in all the other groups were producing relatively well when the experiment began. Apart from group 5 there was a general decline in production from about the sixth to the twelfth week, this coinciding with a period of very severe weather when the birds remained in the house a good deal. In the latter part of the period egg production went up in all groups and it was ascending rapidly at the close of the experiment. The grit consumption per week was variable throughout, all groups varying though not showing any parallelism in this respect. Towards the end of the experiment there was a general decline in the amount of grit consumed, this occurring at a time when production was increasing. Possibly the finer weather and the longer period spent by the birds out of doors explains this feature.

The weight, appearance, body condition and general health of the birds was fully maintained in all groups throughout the entire period of 18 weeks. Examination of the texture of the egg shell revealed no difference as between one group and another in this respect. The texture was remarkably good throughout.

Both types of coral sand as well as the oyster shell proved very palatable to the birds which, as Table I shows, ate considerable quantities. Very much less of the lime mortar was consumed. That the egg production of the lime mortar group, i.e. Group 7, was more or less on a level with that of Groups 1, 2, 3, 4 and 6, and that the birds maintained their weight throughout the 18 weeks of the experiment, suggest an intake of calcium by that Group sufficient for body needs. From this it may be inferred that the intake of calcium by the birds having access to both types of coral sand as well as by those allowed oyster shell was in excess of requirements.

Any appreciable insufficiency of lime or improper utilisation thereof or any toxicity of the " grit " supplements used would, in the case of birds in production, be revealed in a decline in egg yield, a change in the texture of the eggshell, a reduction in the weight of the birds or a depreciation in health or vigour. In no group was there even a suggestion of any of these effects and their non-occurrence is better proof of the adequacy of the supply of lime than is actual egg yield.

SUMMARY.

1. Two coral sands obtained from the south-west coast, one a slatey-grey, containing 30 per cent. of calcium, and the other a brown coloured variety,

containing 32.8 per cent of calcium, were compared with ground oyster shell for the purpose of supplying lime to laying hens : the opportunity was availed of to test lime mortar for the same purpose.

2. Each type of coral sand was consumed as freely by the fowl as was oyster shell : much less of the lime mortar was eaten.

3. In comparison with the birds supplied with the oyster shell those given coral sand, whether of the brown or grey variety, enjoyed equally good health, maintained their body weight and condition equally well, and layed eggs the shell of which showed equally firm texture : similar results were obtained from the birds given a supplement of lime mortar in lieu of oyster shell.

4. The results gave no indication of any difference between the effects of oyster shell, coral sand and lime mortar on egg production.

5. The coral sand used contained no substance inimical to the health of the food.

ACKNOWLEDGMENT.

The writers gratefully acknowledge the co-operation and assistance of Miss E. M. Burke, of the Animal Nutrition Department of the College, in conducting this experiment.

(Received for publication on 31st July, 1941).

THE LAYING DOWN OF LAND TO HAY AND PASTURE

Close on 300,000 acres of grass seed mixtures are sown for hay and pasture in this country every year. The resulting leys vary greatly in quality. The first crop hay, at least on the better soils, is usually satisfactory and often excellent. Really high-class new pastures, on the other hand, are the exception rather than the rule. The leys appear to deteriorate after the first year or two, as the grasses and clovers sown in the mixture more or less rapidly die out and their places are taken by weeds and inferior grasses. This deterioration in new leys and their failure to produce even on fertile soils a good grazing sward is, in the majority of cases, due to the use of unsuitable seeds mixtures.

Carefully seeded and well managed leys are essential for success in tillage farming. Grass (including, of course, clover) is the best of all fodders. The soil of properly managed pastures increases in fertility. Quite remarkable amounts of nitrogen, which in the form of an artificial fertilizer is such an expensive commodity, is taken from the atmosphere and " fixed " by clovers. The clovers themselves use a portion of this fixed nitrogen for their own nutrition but under favourable soil conditions, including the presence in the soil of adequate supplies of lime and phosphate, a fixation considerably in excess of the requirements of the clover occurs and this extra nitrogen can at once be utilized by the grasses and other sward species, which accounts for the rich dark green colour (indicating abundance of nitrogen) of swards containing much Wild White Clover. Part of this gift of nitrogen from the air goes via the herbage to be used in the formation of important constituents of meat and milk. A portion, often the major part, is at once returned to the pasture in the form of manure by the grazing animal to serve soon again as a nutrient for the herbage or alternately to find its way into the soil humus where it will be safely stored. In this way fertility can be accumulated and the land under proper management will be in a greatly improved condition when it is next broken for a rotation of tillage crops.

The full advantages of laying land down to grass cannot be achieved unless, keeping the dual object (fodder and fertility) in view, the principles of seeding the ley as well as the manuring and management of it are well understood and carefully put into practice. In the first place it is essential to have a knowledge of the more important characteristics and potentialities of those grasses and clovers of which the seeds are available in commerce. It is from among these that the choice has to be made when drawing up the seeds mixture. In the following brief notes the chief characteristics of the essential species are summarised.

Perennial Rye Grass—unexcelled by any other for all-round usefulness; occurs invariably in pasture on medium and good soils. Like all the better types it demands a fairly high level of fertility, and will respond generously to good treatment. On poor classes of soil and in exposed situations it dies out rapidly unless carefully managed and manured.

Italian Ryegrass—fast growing; short lived; excellent for short leys, soiling and catch crops and as a constituent of new pastures grazed from the start. When sown in large amount and allowed to develop unchecked it tends to smother out pasture types such as Wild White Clover: for longer leys omit or keep seeding rate low and graze when necessary to keep the grass in check.

Cocksfoot—stands next in order of excellence to Perennial Rye Grass as a hay and pasture grass; tends to become rough and unpalatable when undergrazed; coarse tufts can be avoided by carefully managed grazing and the encouragement of Wild White Clover which mixing with the Cocksfoot sweetens the herbage and induces uniform grazing.

Timothy—ranks among our best grasses, especially for hay. Thrives best on fertile loams and lowland soils, but appears to be adapted to a wide range of conditions and should be included in mixtures for most situations.

Rough Stalked Meadow Grass—an excellent pasture grass preferring the heavier soils; besides giving valuable herbage it serves a useful purpose in forming a close mat which helps to delay the entry of pasture weeds.

Meadow Fescue—demands fertility; sensitive to competition; a substantial contribution to a mixed sward can only be secured by heavy seeding and careful management; scarcely repays inclusion in a mixture; best omitted in most cases.

Crested Dogstail—can be very usefully included in mixtures for soils that are naturally poor as it persists better than the Rye grasses in such cases. It is unnecessary to sow it on the better soils.

Red Clovers—essential for bulk and quality in first crop hay; very important soil improvers. The Red Clovers of commerce fall into two groups—

(i) The early flowering Reds variously known as Broad Red, Common Red Clover, Double-cut Cow Grass, or simply Red Clover.

These make rapid early growth and give a heavy aftermath, hence the name, Double-cut. These Reds are short lived (under two years) a fact which combined with their fast (smothering) growth renders them unsatisfactory for longer ley mixtures unless a low rate of seeding and careful management are adopted. The foreign Broad Reds (French, Italian, Chilian) appear to be unsuitable for our climatic conditions and often give poor returns. Farmers who wish to sow a Broad Red are recommended to use English Broad Red or one of the excellent distinct strains now available.

(ii) Late flowering or Single-cut cow grass Red Clovers.

These are longer lived; give less aftermath and come into flower ten days or

more later than the Broad Reds. Under favourable conditions of soil and management a good proportion of the plants will survive in a pasture for five or six years or more. English Single Cut is suitable for our longer leys but the extra late flowering strains, Montgomery and Cornish Marl, appear to be superior to all others hitherto tested for yield and persistence.

Note.—The price of seed of the late flowering Red Clovers is usually double or treble that of the Broad Reds and as the seed of all the Red Clovers are more or less similar in appearance and indistinguishable from one another, it is important that supplies be obtained from reliable sources.

Alsike—useful on cold, damp, heavy and peaty soils; lasts longer than Broad Red Clover; may be omitted where Red Clover succeeds.

White Clover—an indispensable pasture species; it increases the yield, palatability and nutritive value of grazing land and, of course, helps greatly to raise the soil fertility. It flourishes only under short grass conditions and makes little or no contribution to tall hay crops.

There are two types, viz. (1) Ordinary, commercial, or so called Dutch White, and (2) Wild White.

Ordinary White has a possible use in short (two year) grazing leys but serves no useful purpose whatever in mixtures for the longer hay-then-pasture leys. Wild White should invariably be sown in longer ley mixtures.

MANURING.

Before discussing details of mixtures some consideration must be given to the question of manuring. On the whole the commercial grasses and clovers are what have been described as "fertility-demanders" and require relatively favourable conditions for their proper establishment and persistence. The better the soil on which they are sown the greater the chance they will have of outgrowing and suppressing the ever-present weeds and dominating the herbages Under conditions of low fertility they make little headway and soon give place to such undesirable species as Yorkshire Fog and Common Bent among the true grasses not to mention the numerous grassland herbs which are familiar as weeds in impoverished and ill-managed pastures. Most of the many failures of Red Clover (apart from the sowing of unsuitable varieties) are due simply to phosphate-deficiency and lack of lime.

On naturally poor soils or soils that have been impoverished through mismanagement it is waste of money to sow, expensive seeds mixtures until adequate dressings of Phosphate, Potash and if necessary lime have been given. Such soils should receive a dressing of 1—2 tons of lime, 4—6 cwt. of a suitable phosphatic manure and 2 cwt. of Kainit or an equivalent quantity of Potash Salt per statute acre. The lime is best applied in the autumn preceding sowing and the potash and Phosphate at seeding time.

THE SEEDS MIXTURE.

In districts where mixed farming is practised the duration of the ley is seldom ever less than three years. As a rule it extends to four or five years and often to longer periods thus tending to qualify for the popular designation of permanent pasture. The ley is almost invariably meadowed the first year, often a second crop of hay is taken and grazing follows for the remainder of the period until the break. The seeds mixtures most in demand therefore at the present time are of the longer ley type and they ought, if possible, to be adapted to the hay-then-pasture mode of management.

In considering the question of the actual duration of these longer leys it may be emphasised that in compounding a seeds mixture for a hay (first year) followed by pasture (subsequent years) there is nothing to be gained by distinguishing between leys of three years and those of longer duration and attempting to introduce slight modification into the mixture accordingly. The mixture for a three year ley must be mainly composed of the seeds of the longer lived and more persistent types of grasses and clovers in the same way as one for a four years ley or a permanent pasture. No useful modifications can be made in the seeds mixture to correspond to these different durations. For leys of three years duration and upwards short-lived types such as Italian Rye Grass and Broad Red Clovers, excellent as they undoubtedly are for quick returns and heavy yields in one or two year leys, must be avoided or if included, sown at a low rate of seeding and skilfully managed. Types which die out in a year or two are undesirable as they leave the ground bare and open to invasion by grassland weeds. As a rule, too, short lived species come away quickly from seed making a rapid and bulky growth which is likely to cause serious damage by shading. They tend in fact to smother out in the early stages the slower-growing but longer-lived pasture types, such as Rough Stalked Meadow Grass, and Wild White Clover. It is by the pasture that the seeds mixtures for these longer leys must be judged. The first crop hay is no real test, for any mixture that contains even a half a bushel of Rye grass and a couple of pounds of Red Clover per acre hardly ever fails to give satisfactory first crop hay on any land that is in fairly good heart.

Inattention to such points as these is chiefly responsible for the indifferent character of so many of our newly laid down pastures and has helped furthermore to give rise among farmers to the widespread idea that once a high-class old pasture field has been broken up it is almost impossible to get a sward of the same quality back again. This idea is altogether erroneous ; there is no risk of this kind involved in ploughing up old pastures. Swards not only as good but in many cases greatly superior to those found on the majority of old pastures can be produced with certainty if the necessary care be given to the selection of the seeds mixture and the management of the young leys.

The final selection of the grasses and clovers to be included in the mixture

will depend to a great extent upon local circumstances, such as the type of soil, its situation, altitude and exposure, and its condition especially as regards supplies of the essential plant nutrients. Accordingly, farmers should keep a careful note of the details of the mixtures they sow and at the proper time try to form an estimate of the contribution which each of the different constituents makes to the hay and pasture. Information obtained in this way is of the greatest value in making up mixtures to suit local conditions. Farmers who have difficulty in recognising the different grasses and clovers should seek the help of the Instructor in Agriculture.

On the better soils and on lands that have been well handled and have received a liberal dressing of farmyard manure during the rotation the following mixture, which has been tested extensively, should be tried :—

Leys of three years and upwards, hay followed by pasture :

Mixture I.	*Statute acre*
Perennial Rye Grass	14 lb.
Italian Rye Grass	4 ,,
Cocksfoot	8 ,,
Timothy	5 ,,
Rough Stalked Meadow Grass	2 ,,
Late Flowering Red Clover	2—3 ,,
Wild White Clover	½—1 ,,

For poor soils and exposed situations a more suitable mixture would be :—

Mixture II.	*Statute acre*
Perennial Rye Grass	21 lb.
Italian Rye Grass	4 ,,
Cocksfoot	6 ,,
Crested Dogstail	3 ,,
Late Flowering Red Clover	2 ,,
Alsike	2 ,,
Wild White Clover	½—1 ,,

In these mixtures half or more of the seed of the Perennial Rye Grass and Cocksfoot may with advantage in each case be of an indigenous or pedigree pasture strain if genuine seed is to be had at a reasonable price. The indigenous strains produce more and better pasteurage and persist longer than the commercial types.

Leaving out Italian Rye Grass altogether would not appreciably reduce the yield of first crop hay. A small seeding will, however, provide autumn grazing when the nurse crop has been removed and also in the following spring. It is well known that grazing with the incidental trampling and manuring by livestock plays an important part in the formation of the pasture.

SHORT LEYS.

For one- and two-year leys the Rye grasses, Red Clovers and Alsike are usually expected to provide all that is necessary. Cocksfoot and Timothy can, however, often be introduced into two-year leys with advantage. Typical mixtures in lb. per statute acre are :—

	A	B	C
Italian Rye grass	15	6	6
Perennial Rye grass	—	14	—
Timothy	—	—	14
Late Flowering Red Clover ...	—	2	3
Broad Red Clover	4	2	—
Alsike	—	1	1

Mixture A is suitable for one year only giving stubble grazing and aftermath as well as a cut for hay, soiling, or ensilage. B, which may be used for one or two years, gives less aftermath : if required for two years Cocksfoot at rate of 6 to 8 lb. per acre may be included and the total rye grasses reduced by about half. Mixture C is a good type for one or two years under rich, moist conditions and on well drained lowland soils which are peaty or moory. The rye grass may be omitted from this mixture if desired.

In the case of two year leys 1 or 2 lb. of ordinary white clover seed may with advantage be added to the mixture.

SOWING.

As grass and clover seeds are small a fine seed bed is essential. If the ground is rough or lumpy a substantial proportion of the seeds will get buried and fail to germinate. Good cultivation followed by rolling (when the ground is dry) brings the soil into the best condition. The seed bed must be firm. If it is soft or spongy the seedlings will fail to get a grip and will die out easily in dry weather.

As a matter of convenience seeds mixtures are seldom sown alone, that is apart from a cereal crop, except in the case of rye grass and clover for catch crops. The cereal—wheat, oats or barley—which happens to be employed in "letting out" or "laying down" the land is usually referred to as the nurse crop, whether it acts as a help or a hindrance to the young grasses and clovers. Far from being a help to the young seedlings the corn crop not uncommonly imposes a very severe handicap and as all farmers know, if lodging occurs, the "seeds" may miss altogether. On the whole, however, quite reasonably successful "strikes" of seeds mixtures are secured if the seed bed is in good condition, the corn is not too thick, and the sowing is completed in good time and before the corn crop has got too far ahead. For the best establishment the seeds should be sown at the same time as the corn crop. If this is done, however, there is a risk of

getting too much grassy " butt " in the sheaves at harvest time making it more difficult, of course, to save the corn. Good results are usually obtained if the seeds are sown when the corn has brairded and the young plants are showing two or three leaves. The ground has settled down by this time and a satisfactory seed-bed—fine and firm—can be prepared with little trouble. After sowing the ground is given a stroke of a chain harrow, light spike-harrow or bush harrow to cover the seeds and the job is completed by rolling. It has been pointed out that in the current practice of sowing the seeds in conjunction with a regular corn crop the young leys are often placed at a serious disadvantage. Up to the present, however, the method of laying down leys independently of corn crops, though often advocated within recent years, has to only a slight extent been adopted. It may not always be convenient to work this system on farms where definite rotations are strictly followed, but it can be employed with great effect for the purpose of creating new and greatly improved swards on grasslands that have become worn out and weedy. The land is ploughed up, a seed bed prepared, a dressing of phosphate and if necessary of lime given, the seeds sown and normally the new pasture should be ready for grazing in eight or ten weeks

Rape (3—4 lb. per acre) or a light seeding of oats or barley to be cut for hay or silage can be made to perform the function of a genuine nurse crop and shelter the seedlings in their early stages. The seeds may be sown in spring in which case it is advisable to use a nurse crop or in late summer (July—end of August) when the nurse crop may be omitted. The beneficial effects of grazing with its attendant trampling and manuring have already been alluded to. Grazing, as has been said, is an essential condition for the formation of a satisfactory pasture. Animals, should therefore, be got on to the new sward in good time.

NOTES ON THE MANAGEMENT OF LEYS.

Mixtures, of the types suggested above, normally give a heavy yield of first crop hay, composed mainly (80 per cent. or more) of Rye grass and Red Clover The other sown species with the exception of Alsike and, in certain circumstances. Cocksfoot contribute little or nothing to the first crop hay. Taking hay (or silage) in the first year does not interfere seriously with a mixture's pasture-forming abilities provided the sward is cut in good time and the smothering effects of the tall-growing elements eliminated. When the hay has been cut species like White Clover and Rough Stalked Meadow Grass which have hitherto been suppressed are offered an opportunity of making some growth. With this in mind care should be taken to prevent a heavy aftermath of Red Clover developing when the first crop hay has been made up. From this stage onwards the herbage must be kept short so that White Clover will spread and in conjunction with other species cover the ground with a close mat. In this way weeds are excluded from the start. As pointed out earlier White Clover flourishes only under short-grass conditions. It may be emphasised again that carefully managed grazing is the best treatment the pasture can receive. New leys are rarely injured by autumn grazing as long as the ground is dry. Very often, however,

they are seriously damaged by hard grazing early in the spring. The Rye grass, for instance, which starts into growth early, receives a check from which it dose not recover for the rest of the season and the pasture tends to run variously to Wild White Clover (in excess), bent grass or daisies, according to local conditions. The way to avoid damage by early spring grazing (and it is one of the main reasons for the poor quality of our pastures) is obviously to make ample provision of fodder in the form of roots, kale, hay and silage, supplemented, if necessary, by catch crops which should be ready for use early in the spring. Another way of dealing to some extent with the problem is to apply to certain pastures a dressing of nitrogenous fertilizer in February to induce an early growth of the herbage. The adoption of these suggestions will remove the necessity for turning out stock too early in the season to damage pastures.

Pastures of a few years standing are always greatly improved by a severe harrowing in the winter and where young stock or dairy cows are being grazed dressings of phosphatic manure at intervals of a few years are essential.

(Leaflet No. 24).

FOOD PRODUCTION IN THE GARDEN AND ALLOTMENT

SEASONAL NOTES.

MARCH AND APRIL.

March and April are the busiest months of the year for Gardeners and Allotment holders who desire to produce the maximum yields of food crops during the coming summer and autumn.

Successful results depend largely upon :—

(1) Thorough preparation of the soil.
(2) Careful preparation of the seed bed.
(3) Correct timing of the operations of sowing, thinning and transplanting.
(4) Frequent hoeing during summer.
(5) Adequate control of diseases and pests.

Advantage should be taken of dry periods to prepare the soil for the sowing of seeds and the planting of crops. The smaller the seed the finer the seed bed required, and care should be taken to avoid puddling or caking the soil by working it during wet weather.

VEGETABLES.

Potato Planting.—Attention is directed to the importance of the potato crop in the present emergency. Early varieties should be planted about the middle of March in drills 24 inches apart, 4-5 inches deep, and the sprouted tubers set at 10 to 12 inches apart in the drills. Suitable varieties are Sharpe's Express, Epicure, Duke of York, Arran Pilot. Mid-season and late varieties should be planted out during April, allowing greater distances between the drills and the sets.

Planting out Cabbages.—Cabbage plants should be planted out early in March in well manured and deeply dug soil. "Flower of Spring," "Harbinger," "Offenham" are examples of suitable varieties for spring planting. Plants already in permanent quarters should be given a dressing of nitrogenous fertilizer and have the soil drawn up to them to form a drill.

Planting out Onions.—Plants of the "Tripoli" or autumn sown varieties of Onions should be planted 4 inches apart in well manured but firm soil.

Potato Onions and Shallots.—May be planted out early in March by pressing

the bulbs into the soil so that the apex is just above soil level. The rows should be one foot apart and the bulbs spaced 8-9 inches apart in the rows.

Jerusalem Artichokes.—Tubers should be planted in March, 15 inches apart in the row.

Peas.—Round-seeded varieties of Peas should be sown as soon as suitable weather is experienced in March. The seed should be sown in a flat furrow six inches wide and 2—3 inches deep. Suitable varieties are Superb, Little Marvel, Pilot. Successional sowings are desirable during April if space is available. Suitable varieties for later sowings are Onward, Lincoln, Stratagem. Supports should be provided as soon as the plants come above ground.

Broad Beans.—Seeds should be sown in March and April in flat drills six inches wide and three inches deep. Two rows of beans should be set five inches apart, allowing eight inches between the seed in the rows, placing the seeds alternatively. Exhibition, Longpod and Broad Windsor are suitable varieties.

Parsnips.—Seeds should be shown in March in clumps of three, at 6 to 8 inches apart in the rows. Suitable varieties are Hollow Crown, Student, Elcombe's Improved.

Onions.—Seed should be sown during suitable weather in March in shallow drills 10 to 12 inches apart. Exhibition, Solidity, Bedfordshire Champion, Ailsa Craig, Danvers Yellow Globe, Golden Monarch, are suitable varieties.

Lettuce.—Seed should be sown out of doors during March and April. Plants which were raised in frames may be purchased for planting out in sheltered sites. All-the-year-round, Trocadero, and Iceberg are suitable varieties.

Carrots.—Seed should be sown in a fine seed bed during April. Three or four seeds should be placed at intervals of four to six inches apart in lines twelve inches apart. In shallow soils, varieties like Early Nantes and French Horn may be grown. In deeper soils, Chantenay, Scarlet Intermediate and St. Valery will be found suitable. As soon as germination takes place, the seedlings should be dusted at weekly intervals with Flake Naphthalene to prevent attacks of Carrot Fly.

Parsley.—A small quantity of parsley seed should be sown early in April. Moss curled is a good variety.

Turnip.—Sowings of White Turnips and Swede varieties should be made during April. Early Snowball, White Milan and Orange Jelly are satisfactory varieties of White Turnip. Garden Swede or Purple Top Swede may be sown swede varieties are required.

Cauliflower Plants should be planted out early in April. After planting, the soil adjoining the stems of the plants should be dressed on two occasions with Calomel dust to control Root Fly Maggot.

Cabbages and Leeks.—Small quantities of seeds of Cabbages, Cauliflowers, Broccoli, and Leeks may be sown in a well prepared seed bed, in March and April. The resulting plants should be set out when the early potatoes are dug. It may be found more convenient to purchase plants of the above-named vegetables rather than raise them from seed where space is limited. Celery plants may also be purchased in the same way, but the trenches should be prepared and manured as soon as possible. Lettuce or Radish may be sown on the banks of soil which are thrown up in making the trench.

FRUIT PRODUCTION.

Apple Scab.—Supplies of Lime Sulphur or of Quicklime and Bluestone for the preparation of the spray to the control of Apple Scab should be procured now. The first spray will usually be applied in late April when the "green bud" stage of development is reached. (See Leaflet No. 84).

American Gooseberry Mildew.—Where this disease is prevalent the bushes should be sprayed with Lime Sulphur or Washing Soda immediately after blossoming. (See Leaflet No. 76).

Big Bud of Black Currant.—Infected bushes should be sprayed when in full flower with "Winter Volck" at the rate of 1 quart to 4½ gallons water. Slight scorching of the edges of the leaves may be caused, but the bushes will soon recover.

Grafting of Fruit Trees.—Apple trees which it is desired to renew will usually be in suitable condition for top-grafting during April.

Strawberries and Raspberries—The beds should be cleared of weeds and mulched with strawy manure. (See Leaflet No. 79).

General.—Every opportunity should be taken to keep the soil frequently hoed to control weeds and conserve moisture.

(Issued February, 1941).

MAY.

1.—VEGETABLE PRODUCTION.

Peas and Beans.—Two additional sowings of peas may be made during the month and also the first sowing of French and Scarlet Runner Beans. Due regard should be given to the necessity for economy in the sowing of seed in view of the limited supplies likely to be available. In this connection it would be well to leave a small number of pea and bean plants to mature so that they may produce seed which can be harvested and dried for sowing next year.

Beetroot, Carrots and Lettuce.—Additional sowings of carrots and lettuce may be made as well as the main sowing of beetroot. (See Leaflet No. 36).

Brussels Sprouts and Cauliflowers.—Plants should be procured and set out in permanent quarters at the distances recommended in Leaflet No. 36.

Lettuce and Onions.—Lettuce plants may be transplanted during suitable weather. Onion plants obtained as thinnings of the earlier sowings often do quite well if transplanted early in May.

Vegetable Marrow.—Seed may be sown out of doors and protected by a frame or other cover until the plants develop and are gradually hardened off. Where a greenhouse or frame is not available it may be found more satisfactory to purchase plants in suitable condition for transplanting. One good plant will require 3 to 4 square yards of space, and a suitable site may often be found on the rubbish heap or manure pit.

Tomatoes.—Plants may be purchased and planted in cold frames about the middle of the month and out of doors towards the end of the month against a wall facing south. (See Leaflet No. 110).

2.—FRUIT PRODUCTION.

Every effort should be made this year to produce maximum crops of all kinds of fruit.

Apples should receive several sprayings to control the scab fungus, and Gooseberries should be sprayed after blossoming to control American Mildew. Further information on these matters is given in Leaflets 76, 79 and 84.

3.—GENERAL WORK.

Hoeing.—Frequent hoeing will reduce weeds and check evaporation during dry periods.

Thinning of Seedlings.—Young plants of vegetables sown earlier in the season should be thinned out where necessary to the appropriate distances. (See Leaflet No. 36).

Staking of Peas and Beans.—Stakes or other supports should be provided for peas as soon as the plants appear through the ground. Scarlet Runner Beans should be provided with long stakes or strands of string. Broad Beans will yield better if a single rope is stretched horizontally along each side of the row of plants to prevent wind damage.

Moulding Potatoes.—The soil should be drawn up to potato plants to protect them from frost and to encourage tuber formation.

Pest Control of Vegetable Plants.—Carrot Fly and Cabbage Root Fly are liable to cause trouble in town gardens. They may be controlled by applying naphthalene or calomel dust. (See Leaflet No. 101).

Slugs attack many plants and are easily dealt with by using a bait consisting of 1 oz. of powdered Meta and 2 lb. of sawdust. The bait may be spread broadcast near the plants or placed in small heaps at intervals covered with a slate or other material to keep it dry. Bean Aphis and Cabbage Caterpillars often do considerable damage. Control measures are described in Leaflet No. 101.

JUNE AND JULY.

1.—VEGETABLE PRODUCTION.

The month of June may be regarded as the transplanting month, and July as the cultivation month. All types of winter vegetables should be transplanted into permanent quarters as early as possible in June.

2.—SEED SOWING.

Lettuce.—Small quantities of seed may be sown thinly during June and the resulting plants singled later to 6 inches apart.

Peas.—The final sowing of peas should be made about the middle of June. Select an early season quick maturing variety such as Gradus, Little Marvel, etc.

Turnips.—Seeds of white turnips and garden swede may be sown in June and July.

Cabbage for Spring use.—Cabbage seed of such varieties as Rous Lench, Flower of Spring, Offenham, etc., should be sown in a well prepared seed bed about the middle of July.

3.—TRANSPLANTING VEGETABLE CROPS FOR WINTER USE.

Brussels Sprouts.—As this vegetable requires a long season in which to make satisfactory growth, suitable plants should be transplanted into permanent quarters as early as possible in June.

York Cabbage, Cauliflower, Savoy Cabbage, Broccoli and Kale.—Green vegetables

of these types are very valuable in winter and are most nutritious. Plants should be lifted carefully from the seed bed and transplanted into permanent quarters during June and early July. Most of these vegetables may be set out to follow a crop of early potatoes. In general, distances of planting should be 24 inches between the rows and 18 inches between the plants in the rows.

Celery.—Celery plants may be planted in a trench suitably prepared and thoroughly manured. The plants may be set at 8 to 10 inches apart and should be thoroughly watered after planting. Spraying will be necessary to control leaf spot. (See Leaflets Nos. 5 and 101).

Leeks.—Plants will usually be sufficiently strong to set out in permenant quarters at the end of June. The soil should have been well manured previously. The method of planting is described in Leaflet No. 36.

4.—FRUIT PRODUCTION.

Apple spraying and fruit thinning demand attention. Gooseberry Sawfly should be checked before defoliation occurs. Plantations of soft fruit should be dealt with as described in Leaflet No. 79. Branches of plum trees which show the characteristic colouring of Silver Leaf disease should be removed and burned before the middle of June. (See Leaflet No. 84).

5.—GENERAL WORK.

Maincrop varieties of potatoes should be sprayed about the middle of June and again about three weeks later. (See Leaflet No. 14).

Constant hoeing should be practised between the rows of growing crops. As soon as winter vegetables are sufficiently developed the soil should be drawn up to the plants to steady them and to form a drill. Hedges of Privet, Whitethorn and Cupressus Macrocarpa may be trimmed during July.

6.—BEE-KEEPING.

Build up strong stocks during the month of May so that they may be ready to avail of the nectar flow later. Stimulative feeding should be practised when necessary. (See Leaflet No. 34).

Section crates should be prepared and placed in position on strong stocks before the Hawthorn blooms open.

Additional space must be provided in advance of requirements so as to prevent excessive swarming and to secure the maximum return of surplus honey. Feeding with syrup may be necessary if a sudden drop occurs in the nectar flow during June or July.

(Issued April, 1941).

AUGUST TO OCTOBER.

VEGETABLE PRODUCTION.

Cauliflower—A small quantity of cauliflower seed should be sown out of doors during August or early September in a well prepared seed bed. In sheltered situations these plants may stand the winter unprotected, but in most districts it is advisable to transplant them into a frame during October or otherwise protect them from severe frost. Early London is a suitable variety.

Onions.—Seed of varieties suitable for autumn sowing may be sown out of doors in a well prepared seed bed about the middle of August (see Memorandum on Cultivation of Onions).

Celery.—Side shoots should be removed from celery plants which should then receive a light moulding up. Further mouldings may be given at intervals of about three weeks. Celery Leaf Blight should be controlled as advised in Leaflet No. 5.

Cabbage.—Early in September the strongest of the cabbage plants available from a July sowing should be transplanted into permanent quarters. Where space is limited, the rows may be 15 inches apart and the plants 12 inches apart in the rows. (See Leaflet No. 36).

Lettuce.—Seeds of hardy varieties such as White Passion, Stanstead Park Imperial, etc., should be sown out of doors about the middle of August and transplanted into permanent quarters in late September or early October

SMALL FRUITS.

Strawberry plantations may be laid down during August. Care should be taken to obtain disease-free runners for planting. Established plantations of strawberries and those of other small fruits should be dealt with as described in Leaflet No. 79.

SEED SAVING.

As supplies of vegetable seeds are scarce and as there is little likelihood of securing additional stocks through the usual channnels, growers are earnestly urged to save as much seed as possible this season. While the saving of certain types of vegetable seeds may present difficulty there is no reason whatever why every grower should not save sufficient seed of peas and beans for his own use.

Surplus pods of beans and peas should be collected when mature, the seeds dried and stored for sowing next season, or for domestic use during winter.

The harvesting of seed of other vegetables will require attention at frequent

intervals. Cabbages, carrots, parsley, parsnips, etc., selected from last season's cirops for seed production will have produced flower heads. These should be removed, when large numbers of them turn brown, and be placed in close-meshed canvas or paper bags in a dry shed to complete the ripening process.

If onion seed is late in maturing, the stalks should be cut off near ground level as soon as the seed turns black, and be laid thinly in a dry, airy, shady place to ripen. The seed heads may then be stored in close-meshed canvas bags.

Lettuce seed ripens irregularly over a long period. The plants should be examined frequently and the mature flower heads harvested branch by branch before shedding occurs.

The removal of seed from the seed pods, subsequent to harvesting, is accomplished by beating the pods or rubbing them through the meshes of a cloth or canvas bag. The pods or seed cases of some vegetables may, of course, be shelled by hand.

After the removal of the seed it should be cleaned by sieving or winnowing lightly.

Seed should never be stored in air tight containers. It should be placed in cloth or paper bags and kept in a dry warm room or building.

When harvesting crops of parsnips, carrots and beetroot it is advisable to select and set apart a number of roots for seed production next season. Such roots should be of good type and free from disease or malformation. They should be stored carefully, taking care not to damage the bud in the centre of the crown as this will produce the flowering stem when the roots are transplanted in Spring.

HOME PRESERVATION OF FRUIT AND VEGETABLES.

Surplus supplies of fruit, rhubarb and tomatoes should be preserved by bottling as described in Leaflet No. 88.

The home bottling and canning of vegetables is not recommended unless a pressure cooker capable of maintaining adequate steam pressure is available.

HARVESTING AND STORING VEGETABLES AND FRUIT.

Every effort should be made to prolong the period during which vegetables will be available for home use by storing them under suitable conditions.

Potatoes and root vegetables such as carrots and beet are particularly suitable for prolonged storage.

Potatoes.—Maincrop varieties of potatoes may be stored for a considerable time if lifted in suitable condition. Small quantities may be stored in sheds or other buildings, while larger quantities may be clamped or pitted out of doors.

The main points are :—

(1) The tubers should be dry, mature, and free from disease when stored.
(2) Ventilation should be given for some time after storage.
(3) Sufficient covering should be provided to protect the tubers from frost damage.
(4) Light should be excluded at all times, and sprouting controlled in Spring.

Making a potato clamp or pit.—A well drained portion of the plot or garden should be selected and a strip not more than three feet wide and of adequate length marked off. The potatoes should be graded, all diseased tubers being removed, and piled in a triangular heap which should be covered with "drawn" straw laid on like thatch to prevent rain penetrating into the pit. The straw should then be covered to a depth of about three inches with a layer of soil obtained by digging a shallow trench about the clamp or pit. By this arrangement adequate drainage is provided. Ventilation shafts consisting of wads of straw should be arranged at intervals along the ridge of the pit. Before frost sets in additional soil must be added for the protection of the tubers.

Beetroot.—Lift the roots before frost occurs. Twist off (do not cut) the foliage and arrange the roots (top outwards) in layers separated by moderately dry soil or sand. Protect from rain and frost.

Carrots.—Lift about the end of October. Trim the tops with a knife, store with the crowns outward in a shed or clamp, and protect from frost.

Parsnips.—Parsnips are hardy, and develop the best flavour when left in the ground until required. If necessary, the roots may be dug and stored in sand in a clamp covered with straw and soil.

Onions.—Well ripened bulbs of onions should be stored as advised in the Department's Memorandum on the Cultivation, Harvesting and Marketing of Onions.

Tomatoes.—Outdoor tomatoes which have reached mature size but have not ripened, may be stored by wrapping separately in paper and placing in a cupboard in a warm room.

Apples.—Certain varieties of apples may be stored for considerable periods in cool sheds, cellars or other buildings. (See Memorandum on the Home Storage of the Apple Crop).

Stocks should be examined after the honey flow is over and feeding arranged if necessary, so that strong stocks will be built up for wintering. Supplies of bee candy should be obtained, and treatment given for Acarine disease. Further details are contained in Leaflet No. 34 and in the Department's Memorandum on the Control of Acarine Disease.

(Issued July, 1941).

INDEX TO VOLUME XXXVIII.